Final Report

VOLUME I

FEASIBILITY STUDY FOR HVAC UPGRADE
FORT RILEY, KANSAS

ENERGY ENGINEERING ANALYSIS PROGRAM (EEAP)

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VOLUME II - FIELD SURVEY FORMS
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LIST OF ABBREVIATIONS

ACC	-	air cooled condenser
ACCU	-	air cooled condensing unit
AHU	-	air handling unit
ANSI	-	American National Standards Institute
ASCE	-	American Society of Civl Engineers
BLR	-	boiler
CDP	-	condensate pump
CH	-	chiller
CNW	-	condenser water
CNWR	-	condenser water return
CNWS	-	condenser water supply
COE	-	Corps of Engineers
CV	-	converter
CW	-	chilled water
CWP	-	chilled water pump
CWR	-	chilled water return
CWS	-	chilled water supply
EZDOE	-	Computer program used for calculating building hour energy use.
DD	-	dual duct
DDC		direct digital control
DHRW	-	dehumidification heat recovery unit
DTW	-	dual temperature water
DTWP	-	dual temperature water pump
DX	-	direct expansion
ECO	-	Energy Conservation Opportunity
EMC	-	E M C Engineers, Inc.
F	-	fahrenheit
FC	-	fan coil
ft	-	foot, feet
ft^2	-	square feet
gal	-	gallons
gpm	-	gallons per minute
hp	-	horsepower
hr	-	hour
HRU	-	heat recovery unit
HW	-	hot water
HWP	-	hot water pump
HWR	-	hot water return
HWS	-	hot water supply
H&V	-	heating and ventilating
IR	-	infrared radiant
kW	-	kilowatt, one thousand watts
kWh	-	kilowatt-hours, one thousand watt-hours
lb/hr	-	pounds per hour
LCCA	-	life cycle cost analysis
MAU	-	make-up air unit

MZ	-	multizone
O&M	-	operation and maintenance
OA	-	outside air
psia	-	pounds per square inch absolute
psig	-	pounds per square inch gage
RA	-	return air
RAD	-	radiation heating system
RAF	-	return air fan
rpm	-	revolutions per minute
SOW	-	scope of work
sq ft	-	square foot
STM	-	steam
SZ	-	single zone
temp.	-	temperature
UH	-	unit heater
UMCS	-	utility monitoring and control system
VAV	-	variable air volume
VSD	-	variable speed drive
WAC	-	window air conditioner
yr	-	year(s)

EXECUTIVE SUMMARY

OBJECTIVE

The Feasibility Study for HVAC Upgrade was performed as part of the Energy Engineering Analysis Program (EEAP). The purpose of the Feasibility Study for HVAC Upgrade is to determine the economic feasibility of replacing failed or failing HVAC equipment in 70 buildings at Fort Riley, Kansas. This study is being performed in conjunction with the Feasibility Study for Installation of UMCS at Fort Riley. Two hundred sixteen buildings are evaluated in the UMCS study.

FACILITY DATA AND BUILDING SELECTION

Several types of buildings are evaluated in this study. The building types include administration buildings, barracks, chapels, clinics, dining facilities, maintenance shop buildings, recreational facilities, flight simulator buildings, and training buildings. The energy sources for these buildings include two fuel types, electricity and natural gas.

Seventy buildings were selected from a list of 216 buildings, which are also included in the UMCS feasibility study. Three data sources were used to select the buildings with failed or failing HVAC systems for the analysis. The three data sources included:

- Building lists from the Fort Riley Public Works Energy Branch of specific buildings to include in the analysis.

- List of 235 buildings from the Fort Riley Maintenance Shop listing the condition of HVAC systems and controls.

- Field survey data from 216 buildings surveyed by EMC Engineers, Inc. for the purpose of an UMCS feasibility study.

METHODOLOGY

A field survey was performed to document the HVAC system components for repair and to document information for replacement of existing HVAC systems. HVAC system components were visually inspected for damage, missing parts, and functionality. The HVAC systems were also observed for possible replacement with new, more efficient HVAC systems. Mechanical equipment rooms and building spaces were observed for space requirements and clearances for installation of proposed HVAC system replacements. Building use and building space conditions were also observed as part of the field survey for proposed HVAC system replacements.

HVAC system descriptions and conditions were tabulated from the field survey data. The HVAC system components for repair were listed and repair costs developed. Where applicable, the proposed HVAC systems for replacement were identified and evaluated for technical feasibility for those buildings. Construction costs were developed for the proposed HVAC replacement systems.

The energy savings for HVAC replacement systems were estimated through computer modeling of the existing and the proposed energy efficient HVAC systems. Representative buildings from the UMCS feasibility study were used as the baseline computer models in this analysis. Energy savings for proposed HVAC replacement systems from the representative buildings were prorated on a square foot basis to derive energy savings for similar building HVAC system replacements.

Life cycle cost analyses were performed for the proposed HVAC system replacements in accordance with ECIP guidance, using the calculated energy savings and systems replacement costs. Energy savings and costs for the proposed HVAC system replacements were summarized.

SUMMARY

HVAC system components in need of repair were found in 40 of the 70 buildings evaluated.

The proposed HVAC system replacements were analyzed for 39 of the 70 buildings evaluated. A total of 51 proposed HVAC system replacements were analyzed. The economic analysis for the proposed HVAC system replacements revealed that 32 of the 51 HVAC systems analyzed qualified for the ECIP funding program (simple paybacks below 10 years and SIRs greater than 1.25).

RECOMMENDATIONS

The HVAC system components, presented in Table ES-1 on page ES-4, are recommended for repair to restore the existing HVAC systems to their intended operating condition. Some of the HVAC systems evaluated overlapped between the analyses for HVAC repair and replacement. Those HVAC systems which qualified economically for replacement were removed from the HVAC components for repair list. The total cost for the recommended HVAC system components for repair is $56,887.

The HVAC systems, presented in Table ES-2 on page ES-5, are recommended for replacement with more energy efficient HVAC systems. The 32 proposed HVAC system replacements which qualified for the ECIP funding program are recommended to be submitted for project funding.

The proposed HVAC systems not qualifying for the ECIP funding program were not recommended for replacement. The nonrecommended HVAC system replacements are presented in Table ES-3 on page ES-7.

TABLE ES-1
RECOMMENDED HVAC COMPONENTS FOR REPAIR

BLDG TYPE	BLDG NO.	BLDG NAME	DESCRIPTION OF HVAC COMPONENTS FOR REPAIR	REPAIR COST ($)
Admin. Buildings	302	FINANCE ADMIN	FAN BEARING	91
	313	CIV PERS BLDG	CONDENSER COIL (PLUS COVER)	797
	7636	REGIMENTAL HQ BLDG	CONTROL VALVE 2-1/2"	1,050
	8056	DET DAY ROOM	PUMP, 3/4 HP	744
Admin. & Supply Buildings	7602	ADMIN & SUPPORT BLDG	COOLING COIL, 2ROW, 30" x 30", STEEL PIPE SCH. 40, 1.25" W/HANGERS & 1.25" FIBERGLASS PIPE INSULATION, 1.5" THCK	3,914
	7608	ADMIN & SUPPLY BLDG	COOLING COIL, 2ROW, 30" x 30", STEEL PIPE SCH. 40, 1.25" W/HANGERS & 1.25" FIBERGLASS PIPE INSULATION, 1.5" THCK	3,914
	7652	ADMIN & SUPPLY BLDG	COOLING COIL, 2ROW, 30" x 30", STEEL PIPE SCH. 40, 1.25" W/HANGERS & 1.25" FIBERGLASS PIPE INSULATION, 1.5" THCK	3,914
	7658	ADMIN & SUPPLY BLDG	COOLING COIL, 2ROW, 30" x 30", STEEL PIPE SCH. 40, 1.25" W/HANGERS & 1.25" FIBERGLASS PIPE INSULATION, 1.5" THCK	3,914
Barracks Buildings	7612	ENL BARRACKS W/AS	PUMP SEAL	208
	7614	ENL BARRACKS W/AS	PUMP SEAL	625
	7810	ENL BARRACKS W/O DIN	PUMP SEAL	417
	7814	ENL BARRACKS W/O DIN	PUMP, 2 HP & PUMP SEAL	1,219
	8002	ENL BARRACKS W/O DIN	CONTROL VALVE 1/2" & 3-SPEED FAN SWITCH	2,227
	8012	ENL BARRACKS W/O DIN	CONTROL VALVE 1/2" & 3-SPEED FAN SWITCH	2,227
	8014	ENL BARRACKS W/O DIN	CONTROL VALVE 1/2" & 3-SPEED FAN SWITCH	1,114
	8038	ENL BARRACKS W/O DIN	CONTROL VALVE 1/2" & 3-SPEED FAN SWITCH	2,227
	8040	ENL BARRACKS W/O DIN	CONTROL VALVE 1/2" & 3-SPEED FAN SWITCH	1,114
	8042	ENL BARRACKS W/O DIN	CONTROL VALVE 1/2" & 3-SPEED FAN SWITCH	2,227
	8048	ENL BARRACKS W/O DIN	CONTROL VALVE 1/2" & 3-SPEED FAN SWITCH	1,114
	8050	ENL BARRACKS W/O DIN	CONTROL VALVE 1/2" & 3-SPEED FAN SWITCH	1,114
	8052	SR ENL QTRS	CONTROL VALVE 1/2" & 3-SPEED FAN SWITCH	2,227
Maintenance Shops	723	MNT HANGAR COMB	PUMP SEAL, CONDENSATE PUMP GASKET & CONDENSATE SHUT-OFF CONTROLS	1,439
	727	MNT HANGAR COMB	DAMPER ACTUATOR, PUMP SEAL, CONDENSATE PUMP GASKET, CONDENSATE SHUT-OFF CONTROLS & PUMP MOTOR, 1/3 HP	1,935
	741	MNT HANGAR COMB	REPLACE FOUR STEAM HEATING COILS, 980,000 BTUH CAPACITY EACH	4,975
	820	TAC EQUIP SHOP	CONTROL VALVE 1-1/2", PUMP MOTOR, 10 HP & PUMP SEAL	2,094
	8390	TAC EQUIP SHOP	DAMPER ACTUATOR, CONTROL VALVE 1" & CONTROL VALVE 3/4"	1,975
Recreation & Retail Facilities	202	PHYS FITNESS CTR	CONDENSER COIL (PLUS COVER)	979
	7485	BOWLING ALLEY	VARIABLE SPEED DRIVE W/ CONTRLER,10HP	3,459
	6914	EXC MAIN RETL	CONTROL VALVE 1-1/2", CONTROL VALVE 2", CONTROL VALVE 1-1/4" & DAMPER ACTUATOR	2,098
	6940	INDOOR SWIM POOL	DAMPER ACTUATOR	223
Simulator Building	7739	MOVING TARGET SIMULATOR BLDG	DAMPER ACTUATOR	893
Training Building	6620	COMMUN ACT CTR	PUMP SEAL	417
			TOTAL REPAIR COST	**$56,887**

TABLE ES-2
RECOMMENDED HVAC SYSTEM REPLACEMENTS

BLDG NO.	BLDG NAME	PROPOSED HVAC SYSTEM TYPE	NAT. GAS ENERGY SAVINGS (MBtu/yr)	ELEC. ENERGY SAVINGS (MBtu/yr)	TOTAL ENERGY SAVINGS (MBtu/yr)	NAT. GAS COST SAVINGS ($/yr)	ELEC. COST SAVINGS ($/yr)	DEMAND kW COST SAVINGS ($/yr)	TOTAL ENERGY COST SAVINGS ($/yr)	ANNUAL MAINT. SAVINGS ($/yr)	NON-RECURRING SAVINGS ($)	TOTAL INVESTMENT ($)	SIMPLE PAYBACK (yrs)	SIR
7485	BOWLING ALLEY	Convert DD to DD w/ VAV	(293)	488	196	($1,205)	$5,907	$850	$5,552	$0	$0	$15,055	2.71	5.61
7665	DENTAL CLINIC	Convert MZ to VAV	(107)	301	194	($440)	$3,637	$637	$3,834	$0	$0	$12,210	3.18	4.85
7670	DENTAL CLINIC	Convert DD to DD w/ VAV	(173)	889	716	($713)	$10,760	$958	$11,006	$0	$0	$40,355	3.67	4.26
602	DENTAL CLINIC	Convert DD to DD w/ VAV	(132)	681	548	($546)	$8,237	$1,242	$8,934	$0	$0	$35,342	3.96	3.94
6940	INDOOR SWIM POOL	Replace H&V with Heat Recovery Unit	7,727	706	8,434	$31,836	$8,545	$0	$40,381	$0	$0	$199,226	4.93	3.61
7245	ENL PERS DIN	Replace Kitchen MAUs and Exhaust Fans with Heat Recovery Units	3,511	103	3,614	$14,465	$1,250	$332	$16,047	$0	$30,377	$90,334	5.14	3.49
7606	ENL PERS DIN	Replace Kitchen MAUs and Exhaust Fans with Heat Recovery Units	3,511	103	3,614	$14,465	$1,250	$332	$16,047	$0	$30,377	$90,334	5.14	3.49
7654	ENL PERS DIN	Replace Kitchen MAUs and Exhaust Fans with Heat Recovery Units	3,511	103	3,614	$14,465	$1,250	$332	$16,047	$0	$30,377	$90,334	5.14	3.49
7804	ENL PERS DIN	Replace Kitchen MAUs and Exhaust Fans with Heat Recovery Units	3,511	103	3,614	$14,465	$1,250	$332	$16,047	$0	$30,377	$90,334	5.14	3.49
7856	ENL PERS DIN	Replace Kitchen MAUs and Exhaust Fans with Heat Recovery Units	3,511	103	3,614	$14,465	$1,250	$332	$16,047	$0	$30,377	$90,334	5.14	3.49
6620	COMMUN ACT CTR	Replace SZ AHUs with VAV AHUs	199	478	677	$821	$5,778	$539	$7,138	$0	$30,326	$47,075	5.44	2.99
7404	ENL BARRACKS W/O DIN	Convert two MZs to VAVs	0	364	364	$0	$4,402	$378	$4,780	$0	$0	$26,055	5.45	2.90
410	ENL BARRACKS W/AS	Replace MZs with VAV AHUs	(730)	997	267	($3,008)	$12,061	$1,309	$10,362	$0	$51,813	$77,512	5.98	2.59
402	ENL BARRACKS W/AS	Replace MZs and SZ with VAV AHUs	(730)	997	267	($3,008)	$12,061	$1,309	$10,362	$0	$49,221	$78,851	6.15	2.52
5000	FIRE STATION	Replace MZ with 3 Furnance AC Units, Replace Boiler with smaller Boiler, and Replace ACCU with 3 smaller ACCUs	196	82	278	$808	$991	($47)	$1,752	$652	$72,986	$41,284	6.82	2.48
7245	ENL PERS DIN	Replace Large Steam Boiler w/ Smaller Steam & HW Boilers	1,528	(111)	1,417	$6,295	($1,338)	$0	$4,957	($181)	$101,942	$72,585	7.35	2.47
6620	COMMUN ACT CTR	Convert MZ to VAV	(9)	176	167	($35)	$2,129	($122)	$1,972	$0	$0	$13,076	6.63	2.40
7804	ENL PERS DIN	Replace Large Steam Boiler w/ Smaller Steam & HW Boilers	1,528	(111)	1,417	$6,295	($1,338)	$0	$4,957	($181)	$101,942	$78,207	7.92	2.29
7856	ENL PERS DIN	Replace Large Steam Boiler w/ Smaller Steam & HW Boilers	1,528	(111)	1,417	$6,295	($1,338)	$0	$4,957	($181)	$101,942	$78,207	7.92	2.29
227	ENL BARRACKS W/AS	Replace MZs and SZs with VAV AHUs	(852)	1,163	311	($3,510)	$14,071	$1,527	$12,089	$0	$70,248	$111,119	7.12	2.18
7806	BN HQ BLDG	Replace SZs with VAV AHUs	(95)	263	168	($392)	$3,183	$735	$3,526	$0	$23,323	$34,973	7.45	2.13
7086	UNIT CHAPEL	Replace SZ with VAV AHU	122	92	214	$504	$1,108	$183	$1,794	$0	$12,554	$19,280	7.96	2.09
222	ADMIN GEN PURP	Replace SZ with VAV AHU	(127)	260	133	($523)	$3,145	$809	$3,431	$0	$14,214	$31,811	7.68	2.03
7606	ENL PERS DIN	Replace Large Steam Boiler w/ Smaller Steam & HW Boilers	1,528	(111)	1,417	$6,295	($1,338)	$0	$4,957	($181)	$101,942	$89,312	9.05	2.01
7654	ENL PERS DIN	Replace Large Steam Boiler w/ Smaller Steam & HW Boilers	1,528	(111)	1,417	$6,295	($1,338)	$0	$4,957	($181)	$101,942	$89,312	9.05	2.01
8069	INDOOR SW POOL/GYM	Replace H&V with Heat Recovery Unit	3,223	295	3,517	$13,277	$3,563	$0	$16,840	$0	$35,706	$173,802	9.33	1.90
7178	MOTOR POOL ADMIN	Replace 3 Win. ACs with small SZ w/ DX coil	0	52	52	$0	$628	$826	$1,454	($141)	$4,071	$12,511	8.25	1.89
7245	ENL PERS DIN	Replace SZ AHUs in Dining Area with VAV AHUs	(279)	287	8	($1,151)	$3,477	$381	$2,707	$0	$21,050	$33,387	8.80	1.74

TABLE ES-2
RECOMMENDED HVAC SYSTEM REPLACEMENTS

BLDG NO.	BLDG NAME	PROPOSED HVAC SYSTEM TYPE	NAT. GAS ENERGY SAVINGS (MBtu/yr)	ELEC. ENERGY SAVINGS (MBtu/yr)	TOTAL ENERGY SAVINGS (MBtu/yr)	NAT. GAS COST SAVINGS ($/yr)	ELEC. COST SAVINGS ($/yr)	DEMAND kW COST SAVINGS ($/yr)	TOTAL ENERGY COST SAVINGS ($/yr)	ANNUAL MAINT. SAVINGS ($/yr)	NON-RECURRING SAVINGS ($)	TOTAL INVESTMENT ($)	SIMPLE PAYBACK (yrs)	SIR
7606	ENL PERS DIN	Replace SZ AHUs in Dining Area with VAV AHUs	(279)	287	8	($1,151)	$3,477	$381	$2,707	$0	$21,050	$33,387	8.80	1.74
7654	ENL PERS DIN	Replace SZ AHUs in Dining Area with VAV AHUs	(279)	287	8	($1,151)	$3,477	$381	$2,707	$0	$21,050	$33,387	8.80	1.74
7804	ENL PERS DIN	Replace SZ AHUs in Dining Area with VAV AHUs	(279)	287	8	($1,151)	$3,477	$381	$2,707	$0	$21,050	$33,387	8.80	1.74
7856	ENL PERS DIN	Replace SZ AHUs in Dining Area with VAV AHUs	(279)	287	8	($1,151)	$3,477	$381	$2,707	$0	$21,050	$33,387	8.80	1.74
TOTALS FOR ENERGY SAVINGS, COST SAVINGS, AND INVESTMENTS			32,019	9,679	41,698	$131,911	$117,151	$14,698	$263,762	($394)	$1,131,307	$1,995,765	-	-

TABLE ES-3
NONRECOMMENDED HVAC SYSTEM REPLACEMENTS

BLDG NO.	BLDG NAME	PROPOSED HVAC SYSTEM TYPE	NAT. GAS ENERGY SAVINGS (MBtu/yr)	ELEC. ENERGY SAVINGS (MBtu/yr)	TOTAL ENERGY SAVINGS (MBtu/yr)	NAT. GAS COST SAVINGS ($/yr)	ELEC. COST SAVINGS ($/yr)	DEMAND kW COST SAVINGS ($/yr)	TOTAL ENERGY COST SAVINGS ($/yr)	ANNUAL MAINT. SAVINGS ($/yr)	NON-RECURRING SAVINGS ($)	TOTAL INVESTMENT ($)	SIMPLE PAYBACK (yrs)	SIR
7176	MOTOR POOL MNT SHO	Replace UHs and Steam Boiler with IR Tube Heating System	83	28	112	$343	$344	$0	$688	$600	$24,734	$27,000	10.70	1.56
3	POST CHAPEL	Replace SZ, H&V, Stm Boiler and Cooling Tower with VAV AHU, HW Boiler, and Water Chiller	212	136	348	$874	$1,649	$131	$2,653	$724	$48,583	$68,200	11.75	1.42
820	TAC EQUIP SHOP	Replace HW UHs with Gas-fired Infrared Radiant Tube System; Down size HW Boiler	104	11	115	$427	$133	$0	$560	$370	$43,700	$37,546	12.05	1.42
7739	MOVING TARGET SIMULATOR BLDG	Replace MZ with VAV AHU	(37)	101	65	($151)	$1,227	$283	$1,359	$0	$14,830	$27,484	13.09	1.23
741	MNT HANGAR COMB	Replace Industrial Type UHs with Gas-fired Infrared Radiant Tube System	626	213	839	$2,578	$2,583	$0	$5,161	$600	$63,690	$142,228	15.90	1.07
7602	ADMIN & SUPPLY BLDG	Replace existing SZs with new SZs	0	25	25	$0	$302	$213	$515	$0	$20,550	$24,083	15.62	1.07
7608	ADMIN & SUPPLY BLDG	Replace existing SZs with new SZs	0	25	25	$0	$302	$213	$515	$0	$20,550	$24,083	15.62	1.07
7652	ADMIN & SUPPLY BLDG	Replace existing SZs with new SZs	0	25	25	$0	$302	$213	$515	$0	$20,550	$24,083	15.62	1.07
7658	ADMIN & SUPPLY BLDG	Replace existing SZs with new SZs	0	25	25	$0	$302	$213	$515	$0	$20,550	$24,083	15.62	1.07
6914	EXC MAIN RETL	Convert two MZs to VAVs	(4)	145	141	($18)	$1,757	($18)	$1,722	$0	$0	$29,431	17.09	0.93
7612	ENL BARRACKS W/AS	Replace FCs and SZs with VAV AHUs	2,176	95	2,271	$8,964	$1,151	($1,233)	$8,881	$5,147	$179,196	$434,560	18.90	0.91
7614	ENL BARRACKS W/AS	Replace FCs and SZs with VAV AHUs	2,176	95	2,271	$8,964	$1,151	($1,233)	$8,881	$5,147	$179,196	$434,560	18.90	0.91
7616	ENL BARRACKS W/AS	Replace FCs and SZs with VAV AHUs	2,176	95	2,271	$8,964	$1,151	($1,233)	$8,881	$5,147	$179,196	$434,560	18.90	0.91
7810	ENL BARRACKS W/AS	Replace FCs and SZs with VAV AHUs	2,176	95	2,271	$8,964	$1,151	($1,233)	$8,881	$5,147	$179,196	$434,560	18.90	0.91
7814	ENL BARRACKS W/AS	Replace FCs and SZs with VAV AHUs	2,176	95	2,271	$8,964	$1,151	($1,233)	$8,881	$5,147	$179,196	$434,560	18.90	0.91
8069	INDOOR SW POOL/GYM	Replace H&V with Heat Recovery, Dehumidification, and Pool Heating Unit	3,223	(559)	2,663	$13,277	($6,769)	$0	$6,508	$0	$35,706	$202,172	24.38	0.82
7243	ADMIN & SUPPLY BLDG	Replace 15 Win. ACs with 5 small SZs w/ DX coils	0	50	50	$0	$600	$790	$1,390	($704)	$19,638	$43,596	26.13	0.64
8025	BN ADMIN & CLRM	Convert MZs to VAVs	0	65	65	$0	$791	($112)	$679	$0	$0	$17,282	25.45	0.63
202	PHYS FITNESS CTR	Replace two Industrial Type Unit Heaters in Basketball Gym with four H&V Units	148	20	167	$609	$236	$48	$894	$0	$17,611	$64,001	36.08	0.48

Five energy retrofit projects were identified for HVAC upgrade by the Fort Riley Public Works Energy Branch. These projects were recommended for funding under the Federal Energy Management Program (FEMP). The five projects are presented in Table ES-4.

Table ES-4. HVAC Energy Retrofit Projects Recommended for FEMP

Project No.	Project Description
Project No. 1	**Upgrade HVAC Systems in Dental Clinics**
	• Building 602 - Convert DD AHU to DD VAV AHU
	• Building 7665 - Convert MZ AHU to VAV AHU
	• Building 7670 - Convert DD AHU to DD VAV AHU
Project No. 2	**Upgrade HVAC Systems in Dining Facilities**
	• Building 7245 - Replace SZ AHUs with VAV AHUs - Replace MAUs with HRUs - Replace large STM BLR with smaller HW BLR and smaller STM BLR
	• Building 7606 - Replace SZ AHUs with VAV AHUs - Replace MAUs with HRUs - Replace large STM BLR with smaller HW BLR and smaller STM BLR
	• Building 7654 - Replace SZ AHUs with VAV AHUs - Replace MAUs with HRUs - Replace large STM BLR with smaller HW BLR and smaller STM BLR
Project No. 3	**Upgrade HVAC Systems in Indoor Swimming Pool Buildings**
	• Building 6940 - Replace H&V with HRU
	• Building 8069 - Replace H&Vs with HRUs
Project No. 4	**Upgrade HVAC Systems in Bowling Alley and Community Activiities Center**
	• Building 7485 (Bowling Alley) - Convert DD AHU to DD VAV AHU
	• Building 6620 (Community Activities Center) - Replace SZ AHUs with VAV AHUs - Convert MZ AHU to VAV AHU

Project No.	Project Description
Project No. 5	**Upgrade HVAC Systems in Fire Station, Unit Chapel, Motor Pool Admin, and Battalion Headquarters**
	• Building 5000 (Fire Station) BLR - Replace MZ AHU with three Furnace Air Conditioners - Replace ACCU with three Smaller ACCUs - Replace HW Boiler with Smaller Modular HW
	• Building 7086 (Unit Chapel) - Replace SZ AHU with VAV AHU
	• Building 7178 (Motor Pool Admin) - Replace three WACs with SZ AHU and ACCU
	• Building 7806 (Battalion Headquarters) - Replace SZ AHU with VAV AHUs

The energy savings and economic parameters for the projects are presented in Table ES-5 on the page ES-10.

TABLE ES-5
ECONOMIC SUMMARY FOR ENERGY RETROFIT PROJECTS

FEMP ENERGY RETROFIT PROJECT FOR HVAC UPGRADE	NAT. GAS ENERGY SAVINGS (MBtu/yr)	ELEC. ENERGY SAVINGS (MBtu/yr)	TOTAL ENERGY SAVINGS (MBtu/yr)	NAT. GAS COST SAVINGS ($/yr)	ELEC. COST SAVINGS ($/yr)	DEMAND kW COST SAVINGS ($/yr)	TOTAL ENERGY COST SAVINGS ($/yr)	ANNUAL MAINT. SAVINGS ($/yr)	NON-RECURRING SAVINGS ($)	TOTAL INVESTMENT ($)	SIMPLE PAYBACK (yrs)	SIR
Project No. 1 Dental Clinics (Bldgs 602, 7665, 7670)	(412)	1,871	1,459	($1,697)	$22,639	$2,837	$23,779	$0	$0	$87,908	3.70	4.22
Project No. 2 Dining Facilities (Bldgs 7245, 7606, and 7654)	14,280	837	15,117	$58,834	$10,128	$2,139	$71,100	($543)	$460,107	$622,370	6.65	2.66
Project No. 3 Indoor Swimming Pools (Bldgs 6940 and 8069)	10,950	1,001	11,951	$45,114	$12,112	$0	$57,226	$0	$35,706	$373,029	6.32	2.81
Project No. 4 Bowling Alley and Comm. Act. Center (Bldgs 7485 and 6620)	(103)	1,142	1,039	($424)	$13,818	$1,267	$14,661	$0	$30,326	$75,206	4.65	3.41
Project No. 5 Fire Station, Unit Chapel, Motor Pool Admin, and Bn HQ (Bldgs 5000, 7086, 7178, and 7806)	223	489	712	$919	$5,917	$1,697	$8,533	$511	$112,934	$108,048	7.36	2.23

1. GENERAL DESCRIPTION

1.1 AUTHORITY FOR FEASIBILITY STUDY FOR HVAC UPGRADE STUDY

The Feasibility Study for HVAC Upgrade was performed as part of the Energy Engineering Analysis Program (EEAP). This feasibility study was conducted and prepared under Contract No. DACA01-94-D-0033 issued by the Kansas City District Corps of Engineers on 14 September 1994.

1.2 PURPOSE FOR FEASIBILITY STUDY FOR HVAC UPGRADE STUDY

The purpose of the Feasibility Study for HVAC Upgrade is to determine the economic feasibility of replacing failed or failing HVAC equipment in 70 buildings at Fort Riley, Kansas. This study is being performed in conjunction with the Feasibility Study for Installation of UMCS at Fort Riley. Two hundred sixteen buildings are evaluated in the UMCS study.

1.3 SCOPE OF WORK

The Scope of Work for this EEAP study is presented in Appendix A. The requirements outlined in the Scope of Work are summarized as follows:

- Review the available design, construction, and operational data for the HVAC systems.
- Conduct a field survey of selected buildings to verify construction features, electrical and mechanical equipment, occupancy, and mode of operation for energy analysis; and to evaluate the condition of existing HVAC equipment and controls. A total of 70 buildings will be evaluated for HVAC repair and replacement.
- Evaluate failed or failing HVAC systems identified during the survey to determine necessary repairs.
- Provide recommendations with potential energy savings and economic feasibility for replacing the systems in approximately 30% of the buildings with more efficient systems.
- Provide complete programming or implementation documentation for all recommended projects.
- Prepare a comprehensive report to document the work performed, the results, and the recommendations.

1.4 APPROACH

The approach taken in performing the EEAP study included the following:

- Selecting 70 buildings for evaluation. A field survey was completed on 216 buildings for the purpose of an UMCS feasibility study. The field survey data and data received from Fort Riley Public Works Energy Branch and Maintenance Shop personnel were used to select the 70 buildings for evaluation.

- Performing a field survey to document the HVAC system components for repair and to document information for replacement of existing HVAC systems.

- Interviewing maintenance personnel for HVAC system conditions, operation, and historical data.

- Reviewing existing building drawings, as available.

- Developing HVAC system descriptions and listing HVAC system conditions from the field survey data.

- Determining the HVAC system components for repair; developing repair costs.

- Determining the HVAC systems for replacement; developing systems replacement costs.

- Evaluating the energy savings available for HVAC systems replacement, using computer energy simulations for typical buildings.

- Performing LCCAs for HVAC systems replacement in accordance with ECIP guidance, using the calculated energy savings and systems replacement costs.

  - Nonrecurring savings were included for replacement of existing equipment. Most of the existing equipment for replacement is near the end of its service life. It is estimated that during the next five years the existing equipment will need to be replaced, therefore the non-recurring savings were calculated using the fifth year discount factor.

- Summarizing energy savings and costs for HVAC systems replacement.

The results of the feasibility study analysis are presented in two volumes: Volume I presents the study information, conclusions and recommendations, Volume II contains the appendices and the backup data.

1.5 WORK REMAINING TO COMPLETE PROJECT

There are no tasks remaining to complete this project

2. FACILITY DATA

2.1 GENERAL

Several types of buildings are evaluated in this study. The building types include administration buildings, barracks, chapels, clinics, dining facilities, maintenance shop buildings, recreational facilities, flight simulator buildings, and training buildings. The energy sources for these buildings include two fuel types, electricity and natural gas.

2.2 BUILDINGS INCLUDED IN ANALYSIS

Seventy buildings were selected from a list of 216 buildings, which are also included in the UMCS feasibility study. Three data sources were used to select the buildings with failed or failing HVAC systems for the analysis. The three data sources included:

- Building lists from the Fort Riley Public Works Energy Branch of specific buildings to include in the analysis (see Appendix B).

- List of 235 buildings from the Fort Riley Maintenance Shop listing the condition of HVAC systems and controls (see Appendix B).

- Field survey data from 216 buildings surveyed by EMC Engineers, Inc. for the purpose of an UMCS feasibility study.

The 70 buildings selected for the analysis are presented in Table 2-1 on the following page. The buildings are grouped by use and arranged in tabular format to correspond to the building discussions presented in Section 4.

Table 2-1. Buildings Selected for HVAC Upgrade Analysis

TAB	BLDG NO.	BLDG NAME	SQ FT	USE	EXISTING HVAC SYSTEM TYPE
Admin. Buildings 1	200	ADMIN GENERAL PURPOSE	60,690	Admin - block	Water Source Heat Pumps
	222	ADMIN GEN PURP	18,854	Admin - block	Win. ACs / P. Rad. / SZ
	302	FINANCE ADMIN	16,138	Admin - block	VAV w/ Reheat
	313	CIV PERS BLDG	6,222	Admin - block	SZ w/ Duct Furnance
	500	POST HQ BLDG	65,453	Admin - block	Water Source Heat Pumps
	509	ADM GEN PURPOSE	10,108	Admin - block	Water Source Heat Pumps
	5000	FIRE STATION	8,400	24 hours	MZ / H&V / Gas IRs
	7178	MOTOR POOL ADMIN	2,480	Admin	Gas-Fired UHs / Win. ACs
	7636	REGIMENTAL HQ BLDG	9,850	Admin	Dual Temp. FCs / SZ
	8056	DET DAY ROOM	2,100	Admin	SZ
Admin. & Supply Buildings 2	7243	ADMIN & SUPPLY BLDG	17,829	Admin & Supply	Win. AC / P. Rad. / FCs in building addition
	7432	ADMIN & SUPPLY BLDG	13,500	Admin & Supply	Dual Temp. FCs / H&Vs
	7602	ADMIN & SUPPLY BLDG	13,520	Admin & Supply	SZs (Clg Only) / P. Rad. (All)
	7608	ADMIN & SUPPLY BLDG	13,520	Admin & Supply	SZs (Clg Only) / P. Rad. (All)
	7652	ADMIN & SUPPLY BLDG	13,520	Admin & Supply	SZs (Clg Only) / P. Rad. (All)
	7658	ADMIN & SUPPLY BLDG	13,520	Admin & Supply	SZs (Clg Only) / P. Rad. (All)
	8021	ADMIN & SUPPLY BLDG	23,676	Admin & Supply	Dual Temp. FCs / H&Vs
	8057	ADMIN & SUPPLY BLDG	23,676	Admin & Supply	Dual Temp. FCs / H&Vs
Barracks Buildings 3	227	ENL BARRACKS W/AS	32,303	Barracks - block	MZs
	402	ENL BARRACKS W/AS	35,718	Barracks - block	MZs
	410	ENL BARRACKS W/AS	32,883	Barracks - block	MZs
	540	OFF QTRS MILIT	14,528	Barracks - block	Dual Temp. FCs
	7404	ENL BARRACKS W/O DIN	50,967	Barracks	MZ / P. Rad.
	7612	ENL BARRACKS W/AS	41,892	Barracks	Dual Temp. FCs / SZs
	7614	ENL BARRACKS W/AS	41,892	Barracks	Dual Temp. FCs / SZs
	7616	ENL BARRACKS W/AS	41,892	Barracks	Dual Temp. FCs / SZs
	7810	ENL BARRACKS W/O DIN	41,843	Barracks	Dual Temp. FCs / SZs
	7814	ENL BARRACKS W/O DIN	41,843	Barracks	Dual Temp. FCs / SZs
	7050	ENL BARRACKS W/DIN	39,675	Barracks & Dining	Dual Temp. FCs / H&V / SZ
	7053	ENL BARRACKS W/AS	39,675	Barracks & Dining	Dual Temp. FCs
	8002	ENL BARRACKS W/O DIN	22,700	Barracks	Dual Temp. FCs
	8012	ENL BARRACKS W/O DIN	22,700	Barracks	Dual Temp. FCs
	8014	ENL BARRACKS W/O DIN	11,549	Barracks	Dual Temp. FCs
	8038	ENL BARRACKS W/O DIN	22,700	Barracks	Dual Temp. FCs
	8040	ENL BARRACKS W/O DIN	11,549	Barracks	Dual Temp. FCs
	8042	ENL BARRACKS W/O DIN	22,700	Barracks	Dual Temp. FCs
	8048	ENL BARRACKS W/O DIN	11,549	Barracks	Dual Temp. FCs
	8050	ENL BARRACKS W/O DIN	11,549	Barracks	Dual Temp. FCs
	8052	SR ENL QTRS	22,700	Barracks	Dual Temp. FCs
Battalion Buildings 4	7806	BN HQ BLDG	13,493	Battalian	SZs / P. Rad.
	8025	BN ADMIN & CLRM	12,000	Battalian	MZs / P. Rad.
Chapel Buildings 5	3	POST CHAPEL	8,828	Church - block	SZ / H&V
	7086	UNIT CHAPEL	8,696	Church	SZ / FCs
Dental Clinic Buildings 6	602	DENTAL CLINIC	11,557	Clinic	DD
	7665	DENTAL CLINIC	11,076	Clinic	MZ
	7670	DENTAL CLINIC	14,960	Clinic	DD
Dining Facilities 7	7245	ENL PERS DIN	13,998	Dining	SZs / H&Vs
	7606	ENL PERS DIN	13,493	Dining	SZs / H&Vs
	7654	ENL PERS DIN	13,493	Dining	SZs / H&Vs
	7804	ENL PERS DIN	13,493	Dining	SZs / H&Vs
	7856	ENL PERS DIN	13,493	Dining	SZs / H&Vs

Table 2-1. Buildings Selected for HVAC Upgrade Analysis

TAB	BLDG NO.	BLDG NAME	SQ FT	USE	EXISTING HVAC SYSTEM TYPE
Maintenance Shops 8	723	MNT HANGAR COMB	21,640	Hangar	Flr. Slab Rad. / UHs / P. Rad.
	727	MNT HANGAR COMB	36,152	Hangar	Flr. Slab Rad. / SZ / MZ / UHs
	741	MNT HANGAR COMB	38,898	Hangar	UHs / P. Rad.
	820	TAC EQUIP SHOP	20,564	Maintenance	SZ / UHs / P. Rad.
	1470	AR VEH MNT SHOP	21,667	Maintenance	UHs / SZ / MAU / P. Rad.
	7176	MOTOR POOL MNT SHOP	4,880	Maintenance	UHs
	7920	VEH MNT SHOP DS	124,553	Maintenance	Res. Furn. w/ HC / UHs / SZs / MAUs
	8390	TAC EQUIP SHOP	24,755	Maintenance	H&V / MAU / UHs
Recreation & Retail Facilities 9	202	PHYS FITNESS CTR	51,307	Gymnasium - block	SZ / UHs
	7485	BOWLING ALLEY	36,966	Recreation	DD / VAV
	6914	EXC MAIN RETL	63,930	Retail	SZs / MZs
	6940	INDOOR SWIM POOL	23,347	Swimming Pool	H&V / SZ
	8069	IN SW POOL/GYM	25,620	Swimming Pool	H&Vs / SZ
Simulator Buildings 10	722	FLIGHT SIMULATOR	7,000	Simulator	SZs / VAV
	724	FLIGHT SIMULATOR	13,188	Simulator	MZ / SZ / CRU / P. Rad.
	7739	MOVING TARGET SIM BLDG	4,074	Simulator	MZ / FCs
Training Buildings 11	6620	COMMUN ACT CTR	31,740	Training	SZs / MZ / H&V
	7604	GEN INST BLDG	1,346	Training	MZs
	7656	GEN INST BLDG	13,493	Training	MZs

The analysis includes evaluation of the replacement of existing HVAC systems with more efficient HVAC systems. The energy savings resulting from the replacement of HVAC systems were estimated through computer modeling of the existing and the proposed efficient HVAC systems.

Representative buildings from the UMCS feasibility study were used as the baseline computer models in this analysis. Table 2-2 below presents all 216 buildings from the feasibility study and shows the representative buildings (Comp Model) selected for use in the baseline models.

Table 2-2. Computer Model Buildings for UMCS Study

BLDG NO.	BLDG NAME	SQ FT	USE	COMP MODEL	HVAC SYSTEM TYPE
5000	FIRE STATION	8,400	24 hours	X	MZ / H&V / Gas IRs
313	CIV PERS BLDG	6,222	Admin		SZ w/ Duct Furnace
804	RGT HQ BUILD	10,241	Admin		MZ
7036	REGIMENTAL HQ BLDG	10,010	Admin		FCs / SZ
7178	MOTOR POOL ADMIN	2,480	Admin		Gas-Fired UHs / Win. ACs
7450	REGIMENTAL HQ BLDG	9,850	Admin	X	Dual Temp. FCs / SZ
7636	REGIMENTAL HQ BLDG	9,850	Admin		Dual Temp. FCs / SZ
7834	REGIMENTAL HQ BLDG	9,904	Admin		Dual Temp. FCs / SZ
8010	DET DAY ROOM	2,100	Admin		SZ
8020	DET DAY ROOM	2,100	Admin		SZ
8046	DET DAY ROOM	2,100	Admin		SZ
8056	DET DAY ROOM	2,100	Admin		SZ
8071	RGT HQ BUILD	9,963	Admin		MZ
751	AC PTS & TOE ST	9,834	Admin & Supply		Res. Furn (Htg & Clg) / UHs
810	ADMIN & SUPPLY BLDG	15,152	Admin & Supply		Dual Temp. FCs / H&V
812	ADMIN & SUPPLY BLDG	23,559	Admin & Supply		Dual Temp. FCs / H&V
835	MAF OPS BLDG	19,470	Admin & Supply		VAV / UHs / Flr. Slab Rad.
7212	CO HQ BLDG	19,320	Admin & Supply		Dual Temp. FCs / H&V
7220	CO HQ BLDG	18,870	Admin & Supply		Dual Temp. FCs / H&V
7243	ADMIN & SUPPLY BLDG	17,829	Admin & Supply		Win. AC / P. Rad. / FCs in building addition
7432	ADMIN & SUPPLY BLDG	13,500	Admin & Supply		Dual Temp. FCs / H&Vs
7602	ADMIN & SUPPLY BLDG	13,520	Admin & Supply		SZs (Clg Only) / P. Rad. (All)
7608	ADMIN & SUPPLY BLDG	13,520	Admin & Supply		SZs (Clg Only) / P. Rad. (All)
7652	ADMIN & SUPPLY BLDG	13,520	Admin & Supply		SZs (Clg Only) / P. Rad. (All)
7658	ADMIN & SUPPLY BLDG	13,520	Admin & Supply		SZs (Clg Only) / P. Rad. (All)
7802	ADMIN & SUPPLY BLDG	13,280	Admin & Supply		Dual Temp. FCs / H&Vs
7808	ADMIN & SUPPLY BLDG	13,280	Admin & Supply		Dual Temp. FCs / H&Vs
7852	ADMIN & SUPPLY BLDG	13,280	Admin & Supply		Dual Temp. FCs / H&Vs
7858	ADMIN & SUPPLY BLDG	13,280	Admin & Supply		Dual Temp. FCs / H&Vs
8021	ADMIN & SUPPLY BLDG	23,676	Admin & Supply	X	Dual Temp. FCs / H&Vs
8023	ADMIN & SUPPLY BLDG	23,676	Admin & Supply		Dual Temp. FCs / H&Vs
8057	ADMIN & SUPPLY BLDG	23,676	Admin & Supply		Dual Temp. FCs / H&Vs
8059	ADMIN & SUPPLY BLDG	23,676	Admin & Supply		Dual Temp. FCs / H&Vs
29	RED CROSS BLDG	3,000	Admin - block		Res. Furn.
200	ADMIN GENERAL PURP	60,690	Admin - block		Water Source Heat Pumps
203	CAVALRY MUSEUM	5,800	Admin - block		SZs
205	CAVALRY MUSEUM	16,496	Admin - block		SZs / FCs
207	CAVALRY MUSEUM	8,278	Admin - block		SZs

Table 2-2. Computer Model Buildings for UMCS Study

BLDG NO.	BLDG NAME	SQ FT	USE	COMP MODEL	HVAC SYSTEM TYPE
210	MILIT PERS BLDG	58,448	Admin - block		MZ / VAV / SZ
211	ADMIN	41,062	Admin - block		SZ / CRU / P. RAD.
222	ADMIN GEN PURP	18,854	Admin - block		Win. ACs / P. Rad. / SZ
301	FINANCE ADMIN	32,947	Admin - block		VAV w/ Reheat
302	FINANCE ADMIN	16,138	Admin - block		VAV w/ Reheat
330	DEH ADMIN	14,913	Admin - block		Res. Furn.
364	UEMCS HQ	744	Admin - block		Win. AC / Res. Furn.
403	ADM GENERAL	18,151	Admin - block		Water Source Heat Pumps
405	ADMIN GEN PURP	10,778	Admin - block		Dual Temp. FCs
406	CID BLDG	10,390	Admin - block	X	MZ
500	POST HQ BLDG	65,453	Admin - block		Water Source Heat Pumps
509	ADM GEN PURPOSE	10,108	Admin - block		Water Source Heat Pumps
610	ENL BARRACKS W/AS	29,004	Barracks		MZ / P. Rad.
620	OFF QTRS MILIT	12,640	Barracks		FCs (Htg) / Win. AC Units
621	OFF QTRS TRANS	10,723	Barracks		FCs (Htg) / Win. AC Units
5309	GUEST HOUSE	23,784	Barracks		Dual Temp. FCs
7050	ENL BARRACKS W/AS	39,675	Barracks & Dining		Dual Temp. FCs / H&V / SZ
7053	ENL BARRACKS W/AS	39,675	Barracks & Dining		Dual Temp. FCs
7404	ENL BARRACKS W/O DIN	50,967	Barracks		MZs / P. Rad.
7424	ENL BARRACKS W/O DIN	50,967	Barracks		MZs / P. Rad.
7610	ENL BARRACKS W/AS	41,892	Barracks		Dual Temp. FCs / SZs
7612	ENL BARRACKS W/AS	41,892	Barracks		Dual Temp. FCs / SZs
7614	ENL BARRACKS W/AS	41,892	Barracks		Dual Temp. FCs / SZs
7616	ENL BARRACKS W/AS	41,892	Barracks		Dual Temp. FCs / SZs
7618	ENL BARRACKS W/O DIN	41,892	Barracks	X	MZs
7642	ENL BARRACKS W/O DIN	41,892	Barracks		MZs
7644	ENL BARRACKS W/O DIN	41,892	Barracks		MZs
7646	ENL BARRACKS W/O DIN	41,892	Barracks		MZs
7648	ENL BARRACKS W/O DIN	41,892	Barracks		MZs
7650	ENL BARRACKS W/O DIN	41,892	Barracks		MZs
7810	ENL BARRACKS W/O DIN	41,843	Barracks		Dual Temp. FCs / SZs
7812	ENL BARRACKS W/O DIN	41,843	Barracks		Dual Temp. FCs / SZs
7814	ENL BARRACKS W/O DIN	41,843	Barracks		Dual Temp. FCs / SZs
7816	ENL BARRACKS W/O DIN	41,843	Barracks		Dual Temp. FCs / SZs
7818	ENL BARRACKS W/O DIN	41,843	Barracks		Dual Temp. FCs / SZs
7842	ENL BARRACKS W/AS	41,843	Barracks		Dual Temp. FCs / SZs
7844	ENL BARRACKS W/O DIN	41,843	Barracks		Dual Temp. FCs / SZs
7846	ENL BARRACKS W/AS	41,843	Barracks		Dual Temp. FCs / SZs
7848	ENL BARRACKS W/O DIN	41,843	Barracks		Dual Temp. FCs / SZs
7850	ENL BARRACKS W/AS	41,843	Barracks		Dual Temp. FCs / SZs

Table 2-2. Computer Model Buildings for UMCS Study

BLDG NO.	BLDG NAME	SQ FT	USE	COMP MODEL	HVAC SYSTEM TYPE
8002	ENL BARRACKS W/O DIN	22,700	Barracks		Dual Temp. FCs
8006	ENL BARRACKS W/O DIN	22,700	Barracks		Dual Temp. FCs
8008	ENL BARRACKS W/O DIN	11,549	Barracks		Dual Temp. FCs
8012	ENL BARRACKS W/O DIN	22,700	Barracks		Dual Temp. FCs
8014	ENL BARRACKS W/O DIN	11,549	Barracks		Dual Temp. FCs
8038	ENL BARRACKS W/O DIN	22,700	Barracks		Dual Temp. FCs
8040	ENL BARRACKS W/O DIN	11,549	Barracks		Dual Temp. FCs
8042	ENL BARRACKS W/O DIN	22,700	Barracks		Dual Temp. FCs
8048	ENL BARRACKS W/O DIN	11,549	Barracks		Dual Temp. FCs
8050	ENL BARRACKS W/O DIN	11,549	Barracks		Dual Temp. FCs
8052	SR ENL QTRS	22,700	Barracks		Dual Temp. FCs
8054	ENL BARRACKS W/O DIN	11,549	Barracks		Dual Temp. FCs
27	OFF QTRS MILIT	38,146	Barracks - block		Heat Pumps
214	ENL BARRACKS W/AS	35,821	Barracks - block		MZs
223	ENL BARRACKS W/DAS	47,794	Barracks - block		MZs
227	ENL BARRACKS W/AS	32,303	Barracks - block		MZs
402	ENL BARRACKS W/AS	35,718	Barracks - block		MZs
404	ENL BARRACKS W/DAS	35,718	Barracks - block		VAVs
409	ENL BARRACKS W/AS	32,883	Barracks - block	X	MZs
410	ENL BARRACKS W/AS	32,883	Barracks - block		MZs
411	ENL BARRACKS W/AS	32,883	Barracks - block		MZs
512	SR ENL QTRS	13,619	Barracks - block		Dual Temp. FCs
540	OFF QTRS MILIT	14,528	Barracks - block		Dual Temp. FCs
541	OFF QTRS MILIT	18,083	Barracks - block		Dual Temp. FCs
542	OFF QTRS MILIT	14,528	Barracks - block		Dual Temp. FCs
760	BN HQ BLDG	7,364	Battalian		Stm. P. Rad.
802	BN ADMIN & CLRM	12,526	Battalian		MZs
808	BN ADMIN & CLRM	12,526	Battalian		MZs
7017	BN HQ BLDG	2,604	Battalian		Res. Furn.
7028	BN CLASSROOMS	3,733	Battalion		Dual Temp. FCs
7046	BN CLASSROOMS	3,733	Battalion		Dual Temp. FCs
7031	BN HQ BLDG	3,733	Battalian		Dual Temp. FCs
7033	BN HQ BLDG	4,083	Battalian		SZ
7047	BN HQ BLDG	3,733	Battalian		Dual Temp. FCs
7048	BN HQ BLDG	2,604	Battalian		Dual Temp. FCs
7108	BN ADMIN & CLRM	12,527	Battalian	X	MZ
7109	BN ADMIN & CLRM	13,535	Battalian		VAV w/ Reheat
7215	BN HQ BLDG	2,604	Battalian		SZ / P. Rad.
7218	BN HQ BLDG	12,625	Battalian		MZ
7270	BN HQ BLDG	6,130	Battalian		MZ

Table 2-2. Computer Model Buildings for UMCS Study

BLDG NO.	BLDG NAME	SQ FT	USE	COMP MODEL	HVAC SYSTEM TYPE
7410	BN ADMIN & CLRM	12,599	Battalian		VAV w/ Reheat
7620	BN ADMIN & CLRM	6,340	Battalian		MZ / P. Rad.
7622	BN ADMIN & CLRM	12,380	Battalian		MZ / P. Rad.
7624	BN ADMIN & CLRM	6,158	Battalian		MZ / P. Rad.
7630	BN ADMIN & CLRM	6,158	Battalian		MZ / P. Rad.
7638	BN ADMIN & CLRM	6,158	Battalian		MZ / P. Rad.
7806	BN HQ BLDG	13,493	Battalian		SZs
7820	BN ADMIN & CLRM	6,673	Battalian		SZ
7824	BN ADMIN & CLRM	12,246	Battalian		MZs
7836	BN ADMIN & CLRM	12,246	Battalian		MZs
7854	BN HQ BLDG	13,493	Battalian		SZs
8025	BN ADMIN & CLRM	12,000	Battalian		MZs / P. Rad.
8037	BN ADMIN & CLRM	12,000	Battalian		MZs
5302	POST OFFICE	12,240	Post Office		MZ / P. Rad.
5315	MORRIS HILL CHAPEL	19,748	Church		SZ / FCs
7086	UNIT CHAPEL	8,696	Church	X	SZ / FCs
7865	UNIT CHAPEL	8,718	Church		SZ / Win. AC Units
3	POST CHAPEL	8,828	Church - block		SZ / H&V
6	POST CHAPEL	6,230	Church - block	X	SZs / P. Rad.
253	DRUG ABUSE CTR	11,122	Clinic		SZs
602	DENTAL CLINIC	11,557	Clinic		DD
814	MEDICAL FAC - NEW	9,220	Clinic		MZ
4010	DENTAL CLINIC	15,587	Clinic		DD
7034	CLINIC W/O BEDS	3,842	Clinic		MZ
7626	CLINIC W/O BEDS	3,604	Clinic		MZ
7665	DENTAL CLINIC	11,076	Clinic	X	MZ
7670	DENTAL CLINIC	14,960	Clinic		DD
7826	CLINIC W/O BEDS	3,841	Clinic		MZ
8065	CLINIC W/O BEDS	3,848	Clinic		MZ
650	COLD STOR FAC	22,331	Cold Storage		
652	COLD STOR FAC	8,167	Cold Storage		
7245	ENL PERS DIN	13,998	Dining		SZs / H&Vs
7606A	ENL PERS DIN (Dining Area)	8,995	Dining	X	SZs
7606B	ENL PERS DIN (Kitchen Area)	4,498	Dining	X	H&Vs
7654	ENL PERS DIN	13,493	Dining		SZs / H&Vs
7804	ENL PERS DIN	13,493	Dining		SZs / H&Vs
7856	ENL PERS DIN	13,493	Dining		SZs / H&Vs
8063	ENL PERS DIN	18,313	Dining		MZ
723	MNT HANGAR COMB	21,640	Hangar		Flr. Slab Rad. / UHs / P. Rad.

Table 2-2. Computer Model Buildings for UMCS Study

BLDG NO.	BLDG NAME	SQ FT	USE	COMP MODEL	HVAC SYSTEM TYPE
727	MNT HANGAR COMB	36,152	Hangar		SZ / MZ / UHs
741	MNT HANGAR COMB	38,898	Hangar		UHs
817	MNT HANGAR AVUM	40,061	Hangar		Flr Slab Rad. / H&V / HCU
833	AIRCRAFT HANGAR	52,080	Hangar		Flr Slab Rad. / H&V / VAV / HCU
853	MNT HANGAR AVUM	48,112	Hangar		Flr Slab Rad. / Gas-Fired H&V / UHs
710	TAC EQUIP SHOP	2,173	Maintenance		SZ / UHs
820	TAC EQUIP SHOP	20,564	Maintenance		SZ / UHs / P. Rad.
840	VEHICLE MNT SHOP ORG	9,152	Maintenance		H&V / SZ / MAU / Win. AC Units / P. Rad. / IR Heaters
1470	AR VEH MNT SHOP	21,667	Maintenance		UHs / SZ / MAU / P. Rad.
7176	MOTOR POOL MNT SHOP	4,880	Maintenance		UHs
7350	VEH MNT SHOP ORG	21,345	Maintenance		Res. Furn. / MAU / Gas Fired IRs
7500	VEH MNT SHOP ORG	22,325	Maintenance		MAUs / Res. Furn. / Gas Fired IRs
7520	VEH MNT SHOP ORG	27,112	Maintenance		MAUs / Res. Furn. / Gas Fired IRs
7760	VEH MNT SHOP ORG	17,163	Maintenance		MAUs / Res. Furn. / Gas Fired IRs
7720	VEH MNT SHOP ORG	22,325	Maintenance		MAUs / Res. Furn. / Gas Fired IRs
7780	VEH MNT SHOP ORG	17,163	Maintenance		MAUs / Res. Furn. / Gas Fired IRs
7900	VEH MNT SHOP ORG	20,943	Maintenance		MAUs / Res. Furn. / Gas Fired IRs
7920	VEH MNT SHOP DS	124,553	Maintenance		Res. Furn. w/ HC / UHs / SZ / MAU
7940	VEH MNT SHOP ORG	22,405	Maintenance		MAUs / Res. Furn. / Gas Fired IRs
7960	VEH MNT SHOP ORG	20,245	Maintenance		MAUs / Res. Furn. / Gas Fired IRs
8100	CONSOLIDATED MNT	224,927	Maintenance		Roof SZs / HRUs
8300	VEH MNT SHOP ORG	20,240	Maintenance	X	MAUs / Res. Furn. / Gas Fired IRs
8320	VEH MNT SHOP ORG	20,240	Maintenance		MAUs / Res. Furn. / Gas Fired IRs
8330	VEH MNT SHOP ORG	39,256	Maintenance		UHs / H&Vs / MAU
8340	VEH MNT SHOP ORG	20,240	Maintenance		MAUs / Res. Furn. / Gas Fired IRs
8360	VEH MNT SHOP ORG	39,428	Maintenance		H&V / UHs / MAU / Win. AC Units / Gas IR Heaters
8370	VEH MNT SHOP ORG	26,876	Maintenance		SZ / H&V / MAU
8380	VEH MNT SHOP ORG	73,400	Maintenance		Gas Fired SZ / H&V / MAU / Gas IR Heaters
8390	TAC EQUIP SHOP	24,755	Maintenance		H&V / MAU / UHs
8410	VEH MNT SHOP ORG	73,233	Maintenance		Gas Fired SZ / H&V / MAU / Gas IR Heaters
1980	RECYCLE CENTER	24,968	Maintenance		Res. Furn. / H&V
615	IACH ENERGY PLANT	10,658	Mechanical		
806	COMB AC-HTG PLANT	1,000	Mechanical		
7210	CH CHILLER PLANT	4,320	Mechanical		
8073	CH ENERGY PLANT	4,070	Mechanical		
202	PHYS FITNESS CTR	51,307	Gym - block		SZ / UHs
5800	YOUTH CTR	21,560	Youth Center		SZ / MZ

Table 2-2. Computer Model Buildings for UMCS Study

BLDG NO.	BLDG NAME	SQ FT	USE	COMP MODEL	HVAC SYSTEM TYPE
6940	INDOOR SWIM POOL	23,347	Swimming Pool		H&V / SZ
7024	GYMNASIUM	20,619	Recreation		H&V / FCs
7632	GYMNASIUM	20,694	Recreation		H&V / FCs
7832	GYMNASIUM	20,694	Recreation		H&V / UHs
8069A	IN SW POOL/GYM	25,620	Swimming Pool	X	H&Vs
8069B	IN SW POOL/GYM	25,620	Swimming Pool	X	H&V / SZ
6910	EXC SP ST FAC	2,525	Retail		Res Furn.
6914	EXC MAIN RETL	63,930	Retail	X	SZ / MZ
7285	CLOTHING SALES	17,042	Retail		SZ w/ Booster Coils
720	AF OPS BLDG	3,705	Simulator		Res. Furns.
722	FLIGHT SIMULATOR	7,000	Simulator		SZs / VAV
724	FLIGHT SIMULATOR	13,188	Simulator	X	MZ / SZ / CRU / P. Rad.
7739	MOVING TARGET SIM BLDG	4,074	Simulator		MZ / FCs
7485	BOWLING ALLEY	36,966	Recreation	X	DD / VAV
7866	THEATER W/DRESS RM	11,098	Theater	X	SZ
206	THEATER W/O DRESS RM	10,754	Theater		SZ
319	GEN INSTRUCTION BLDG	9,690	Training		SZ / P. Rad.
6620	COMMUN ACT CTR	31,740	Training		SZ / H&V
6918	SKILL DEV CTR	11,507	Training		Roof Top SZs / Res. Furn
7264	LIBRARY MAIN	31,240	Training		SZ / P. Rad
7305	APP INSTR BLDG	9,872	Training		Res. Furn. w/ AC
7604	GEN INST BLDG	1,346	Training		MZs
7656	GEN INST BLDG	13,493	Training	X	MZs
8044	APP INSTR BLDG	2,470	Training		Res. Furn.
			TOTAL NUMBER OF COMPUTER MODEL BUILDINGS	**20**	

2.3 ENERGY SOURCES AND CONSUMPTION

2.3.1 Electricity

Fort Riley is served by two electrical substations. The substations are named ANZIO and IRWIN. The electrical energy consumption and electrical demand are metered at these substations. Historical electrical energy and demand use and cost data for fiscal year (FY) 1994 was obtained from billing records at Fort Riley. The electrical power is provided by the Western Resources, Inc. utility company.

Table 2-3 below presents the historical data for FY94 electrical energy consumption and electrical demand metered at the substations ANZIO and IRWIN.

Table 2-3. Historical Data for Electrical Consumption

FY 94	Electrical Demand (kW)	Electrical Demand Cost ($)	Electrical Consumption (kWh)	Electrical Cost ($)[1]
Oct-93	23,799	119,643	11,661,143	502,124
Nov-93	29,089	119,396	12,536,771	528,972
Dec-93	25,479	119,396	14,417,197	582,900
Jan-94	28,540	119,396	14,355,290	581,164
Feb-94	31,095	121,548	13,342,753	555,176
Mar-94	23,364	119,396	12,487,960	527,369
Apr-94	24,630	119,396	11,933,772	510,330
May-94	32,014	124,219	12,540,938	534,752
Jun-94	35,469	137,619	16,953,600	681,157
Jul-94	35,750	138,670	16,754,188	676,880
Aug-94	35,489	134,668	17,613,148	700,116
Sept-94	33,945	131,703	14,756,495	609,992
Totals	358,663	1,505,050	169,353,256	6,990,930
Electrical Demand Unit Cost is calculated using a demand limiting computer spreadsheet provided by the Fort Riley Public Works Energy Branch.			Electrical Energy Unit Cost w/ Demand	$0.0413 / kWh $12.10 / MBtu
			Electrical Energy Unit Cost w/o Demand	$0.0322 / kWh $9.44 / MBtu

1. Cost for kWh includes kW cost.

2.3.2 Natural Gas

Historical data for natural gas consumption was obtained from billing records at Fort Riley. Table 2-4 presents the natural gas consumption and cost data for FY94.

Table 2-4. Historical Data for Natural Gas Consumption

FY 94	Natural Gas Consumption (MBtu)	Natural Gas Unit Price	Total Natural Gas Cost
Oct 93	70,695	$3.88	$274,297
Nov 93	150,142	$4.08	$612,579
Dec 93	186,439	$4.54	$846,433
Jan 94	233,073	$4.19	$976,576
Feb 94	199,962	$4.37	$873,834
Mar 94	130,497	$4.38	$571,577
Apr 94	85,400	$3.96	$338,184
May 94	36,474	$3.98	$145,167
Jun 94	39,047	$3.18	$124,170
Jul 94	39,483	$3.32	$131,084
Aug 94	37,667	$3.24	$122,041
Sep 94	35,304	$3.06	$108,030
Totals	1,244,183		$5,123,971
		Unit Cost of NG	$4.12 / MBtu

3. FIELD SURVEY OF HVAC SYSTEMS

3.1 GENERAL

A field survey was conducted on 70 buildings for the purpose of upgrading the existing HVAC systems. The typical HVAC systems included in the field survey are listed below:

- Air Handling Units
- Fan Coil Units
- Unit Heaters
- Heat Pumps
- Window Air Conditioners
- Water Chillers
- Cooling Towers
- Air Cooled Condensing Units
- Steam Boilers
- HW Boilers
- Steam-to-HW Converters
- HW and CW Pumps

Field survey forms were used to record the existing conditions of the HVAC systems. The field survey forms are presented in Volume II of this report.

3.2 OVERVIEW OF FIELD SURVEY OBSERVATIONS

3.2.1 Typical HVAC System Components for Repair

A vital part of the field survey included the HVAC system components for repair. HVAC system components were visually inspected for damage, missing parts, and functionality. HVAC system components for repair were recorded on the field survey forms. Some of the typical HVAC system components for repair are described below.

Some air handling units were observed to have the following components in need of repair:

- Damper actuators - missing or linkages disconnected.
- Fan Motors - noisy bearings.
- Fans - noisy bearings.
- Control valves - actuators dismantled or leak; valve bodies extremely rusted.

The HVAC system components on chillers, air cooled condensing units, cooling towers, boilers, and converters were observed to be generally in fair condition.

Some pumps were observed to have the following components in need of repair:

- Motors - noisy bearings.
- Pump seals - leaky.

3.2.2 Typical HVAC Systems for Replacement

The HVAC systems were also observed for possible replacement with new, more efficient HVAC systems. Mechanical equipment rooms and building spaces were observed for space requirements and clearances for installation of proposed HVAC system replacements. Building use and building space conditions were also observed as part of the field survey for proposed HVAC system replacements.

In selecting replacement systems, the design philosophy was to identify replacement HVAC systems which would result in reduced maintenance costs and increased reliability, as well as conserve energy. The proposed HVAC systems considered for replacement included:

- Replacement of dual temperature fan coil systems with VAV systems. The VAV system would have the heating and cooling coil at the AHU. Air distribution ductwork would be installed with VAV terminal units to vary air to each room. This system would result in significant maintenance savings as well as significant energy savings.

- Replacement of single zone and multizone systems with VAV systems is an effective way to save energy. With the exception of controls, VAV is the only HVAC replacement option available for these systems capable of saving significant energy. In most buildings, fan energy consumption exceeds cooling energy.

- Conversion of multizone systems to VAV systems. VAV terminal units would be installed on each of the zones ductwork in the MER near the AHU where they are easy to maintain. The existing air distribution ductwork is retained. A VSD on the supply fan would provide significant energy savings.

- Conversion of dual duct systems to VAV systems. Dual duct mixing boxes would be removed, and dual duct VAV mixing boxes would be installed. The existing air distribution ductwork is retained. A VSD on the supply fan would provide significant energy savings.

- Replacement of HVAC systems requiring 100% outside air with heat recovery units. Heat recovery units are very cost effective for replacement of these type of HVAC systems. Typical applications include makeup air units for kitchen hoods in dining facilities and HVAC systems in indoor swimming pools.

- Replacement of single zone and multizone systems with high efficiency residential style furnaces. The high efficiency residential style furnaces are often superior to single zone and multizone systems in terms of low first costs, energy efficiency, and size.

- Replacement of unit heaters in maintenance shops with infrared heating systems. The infrared heating systems are superior to unit heaters in terms of both energy efficiency and thermal comfort.

4. DESCRIPTION AND ASSESSMENT OF HVAC SYSTEMS

4.1 BUILDING 200 (ADMINISTRATION GENERAL PURPOSE)

4.1.1 HVAC System Existing Conditions

Building 200 is a 60,690 sq ft, two-story building with a conditioned basement. It was constructed during the early 1900s and has sandstone block foundations and walls. This building has a variety of administrative offices, an auditorium, and a computer operations center. The building is served by water source heat pumps that provide heating and cooling throughout (except the computer operations center which has a separate HVAC system).

The water source heat pump system was installed in 1986. The main components in this system are heat pumps (console type heat pumps located along walls and below windows or horizontal type heat pumps located above ceilings), condenser water circulating pumps, a cooling tower, 10 thermal energy storage tanks, a flat plate heat exchanger, and two steam boilers. The condenser water is a mixture of 15% propylene glycol and 85% water. The cooling tower is a closed circuit cooling tower.

The water source heat pump system components are in good condition, although the heat pumps have had a tendency to burn out compressors. A number of problems have plagued the system operation from the time it was installed. The problems encountered with the water source heat pump system include the following:

- The heat pumps have leakage problems.
- The heat pumps have compressor burn out problems. This is due to continous operation and system control, as people have the thermostat controls set on full cool or full heat. Ft. Riley maintenance personnel have observed open windows near heat pumps operating in the full heating or full cooling mode.
- The console type heat pumps have been used for shelves to store books and papers, or have desks or cabinets in front of them blocking access. This misuse of the heat pumps has caused air flow blockage resulting in icing of coils and inefficient operation.
- The horizontal type heat pumps above ceilings are difficult to maintain. On these type of heat pumps, access to the unit is gained by sliding the cover off vertically. The heat pump must therefore to be removed from the ceiling space to perform routine maintenance .
- The heat pumps shutdown when the condenser water temperature rises above 85°F or drops below 65°F. The condenser water must be stabilized between these temperatures before the heat pumps can be reset. This building has approximately

133 heat pumps which would need to be reset if the condenser water temperature rises above or drops below the system temperature setpoints.

- The condenser water system piping has developed many leaks. Part of the problem is that the copper pipe fittings were joined together with soft solder. Over time the fittings have begun to leak, and some have completely blown apart causing a tremendous repair effort. Large amounts of the propylene-water mixture have been lost, requiring the system to be refilled. Replacement cost of the propylene-water mixture is very expensive.

- The cooling towers did not receive proper chemical treatment during the first year in service. The chemical treatment was provided under warranty by the installation contractor. A build up of scale occurred inside the cooling towers. As a result, the piping, valves, and spray nozzles were plugged with scale. Maintenance has been done since then to clean out some of the built-up scale.

4.1.2 HVAC System Components for Repair

The HVAC system components were observed to be in good condition and operating at the time of the field survey.

4.1.3 Proposed HVAC System Replacement

The existing heat pump system was installed 9 years ago, and was not considered for a replacement HVAC system.

4.1.4 Recommendations

The problems associated with the water source heat pump system can be grouped into three categories:

- Misuse of the water source heat pumps by building users.

- Intensive maintenance required for water source heat pump system operation.

- Lack of system controls to maintain proper water source heat pump system operation.

The water source heat pump system problems could be alleviated by implementing the following:

- Provide building user training for heat pump operation.

- Continue regular maintenance and replace failed heat pumps with quality heat pumps.

- Install DDC system controls to monitor water source heat pump system operation and water source temperature, and provide alarms to indicate when the system shuts down or when the water source temperaure is out of proper range. Additionally, automatic control valves could be installed at strategic locations on the condenser water piping. If a break occurs in the condenser water piping system, the control valves would close automatically and retain most of the propylene-water mixture.

The water source heat pump system is being evaluated to be upgraded with DDC controls as part of the installation of a UMCS.

4.2 BUILDING 222 (ADMINISTRATION GENERAL PURPOSE)

4.2.1 HVAC System Existing Conditions

Building 222 is a 18,854 sq ft, building. The majority of the building is a single story. The north end of the building has two stories which contain first and second floor administration offices. It was constructed during the early 1900s and has sandstone block foundations and walls. This building has administrative offices, a Class Six liquor store, a training center (currently vacant), a cold storage, and a dry storage.

The following table describes the HVAC equipment serving Building 222.

HVAC System No.	HVAC System Type	Description of HVAC System	Existing Condition
AHU-1	SZ	SZ AHU serves Class Six liquor store and training center	Poor condition - inoperable OA/RA damper actuator
CH-1	Reciprocating w/ Air Cooled Cond.	30 Ton packaged air-cooled water chiller serves AHU-1	Good condition
WAC-1 Thru WAC-9	Window Air-Conditioners	9 WACs provide cooling for the administrative offices (1st & 2nd floors, north end)	Fair condition
RAD-1	Finned Tube Baseboard Radiation	Perimeter radiation provides heating for the administrative offices (1st & 2nd floors, north end)	Fair condition
BLR-1	HW Boiler	350,000 BTUH (output) Boiler serves AHU-1 and RAD-1 perimeter radiation	Fair condition

4.2.2 HVAC System Components for Repair

The HVAC system components were observed to be generally in fair condition. The HVAC system component in need of immediate repair is listed in the following table, with the repair cost.

HVAC System No.	HVAC System Type	Description of HVAC System Component for Repair	Repair Cost ($)
AHU-1	Single Zone AHU	OA/RA damper actuator inoperable - replace. OA/RA dampers are in a fixed position; OA - 0%; RA - 100%.	223

4.2.3 Proposed HVAC System Replacement

The window AC units serving the administration offices were considered for a HVAC system replacement.

The energy savings and economic analyses for window AC units replacement in Buildings 7178 and 7243 wereevaluated previously. For both buildings, the replacements of window AC units were not economically feasible. The window AC units would not likely be economically feasible for HVAC system replacement in Building 222 also.

The SZ AHU is was considered for replacement with a VAV AHU. The VAV AHU would have two zones, one for the liquor store and one for the training center. The following equipment and materials are included in the proposed HVAC system replacement:

- VAV AHU with VSD will replace the SZ AHU.
- VAV terminal units with reheat coils will be installed on the zone supply air ducts.
- Thermostats will be installed in each zone; the thermostats will reset the VAV terminal unit controllers that vary the supply air to the zones.
- Existing ductwork will be modified to serve the two zones, the liquor store and the training center.

Method of Analysis

The EZDOE computer model for Building 222 was used to evaluate energy savings for the proposed HVAC system replacement.

The analysis proceeded as follows:

- The computer model for Building 222 was used as the baseline computer model.
- The baseline computer model was modified to include the HVAC replacement system - the VAV AHU with a VSD. The VSD controls were set to vary the supply air volume down to 20%. The modified baseline is the ECO model.
- The ECO model energy use was subtracted from the baseline energy use to find the energy savings for natural gas and electricity.
- A construction cost was developed for the proposed HVAC system replacement.

- The energy savings and the construction cost were entered into a LCCA worksheet. Additional information entered into the LCCA worksheet included the following:
  - Economic life is 20 years.
  - Avoided cost of existing system replacement was included as a non-recurring fifth year cost.

Energy Savings and Economic Analysis

The energy savings and economic analysis for the proposed HVAC system replacement are included in Appendix D. The results of the analysis are presented in the following table.

Item	HVAC System Replacement Energy Savings and Economics
Annual Electric Energy Savings (MBtu)	260
Annual Electric Demand Savings ($)	809
Annual Natural Gas Savings (MBtu)	(127)
Total Annual Energy Cost Savings	$3,431
Investment Cost	$31,811
Annual Maintenance Cost Savings	$0
Non-recurring Cost Savings	$14,214
Savings-to-Investment Ratio (SIR)	2.03
Simple Payback (yrs)	7.68

4.2.4 Recommendations

The proposed HVAC system replacement is recommended.

4.3 BUILDING 302 (FINANCIAL ADMINISTRATION)

4.3.1 HVAC System Existing Conditions

Building 302 is a 16,138 sq ft, two-story building with an attic space. It was constructed during the early 1900s and has sandstone block foundations and walls. This building has administrative offices on the first and second floors. The attic space is used for storing supplies and has heating only.

The following table describes the HVAC equipment, serving Building 302.

HVAC System No.	HVAC System Type	Description of HVAC System	Existing Condition
AHU-1	VAV w/ Reheat	AHU serves entire building, except for area served by AHU-2	Fair condition, except for noisy fan bearing.
AHU-2	SZ	AHU serves an office / storage room (14' x 25') on the 1st floor. Originally used for a computer room.	Fair condition
ACCU-1	Air Cooled Condensing Unit	25 Ton ACCU serves AHU-1 DX coil	Good condition
ACCU-2	Air Cooled Condensing Unit	Small ACCU serves AHU-2 DX coil	Good condition
UH-1 thru UH-4	HW Unit Heaters	UH-1 through UH-4 serve the attic storage/supply area	Good condition
BLR-1	HW Boiler	600,000 BTUH (output) Boiler serves AHU-1, AHU-2 and UHs	Fair condition

4.3.2 HVAC System Components for Repair

The HVAC system components were observed to be generally in fair condition. The HVAC system component in need of immediate repair is listed in the following table, with the repair cost.

HVAC System No.	HVAC System Type	Description of HVAC System Component for Repair	Repair Cost ($)
AHU-1	VAV w/ Reheat	Fan bearing near fan pulley is noisy; replace both fan bearings	91

4.3.3 Proposed HVAC System Replacement

The HVAC systems in building 302 are not recommended for replacement. Their existing condition is fair to good. The VAV w/ Reheat AHU is an efficient system and should not be replaced.

4.3.4 Recommendations

The HVAC system component for repair is recommended.

4.4 BUILDING 313 (CIVIL PERSONNEL ADMINISTRATION)

4.4.1 HVAC System Existing Conditions

Building 313 is a 6,222 sq ft, one-story building constructed with face brick and concrete block. It is an administrative office building. The following table describes the HVAC equipment, serving Building 313.

HVAC System No.	HVAC System Type	Description of HVAC System	Existing Condition
AHU-1	SZ w/ Duct Furnance	SZ AHU with Duct Furnance and DX cooling coil serves entire building	Fair condition
ACCU-1	Air Cooled Condensing Unit	12 Ton ACCU serves AHU-1 DX coil	Poor condition - condenser coil fins are damaged

4.4.2 HVAC System Components for Repair

The SZ HVAC system components were observed to be generally in fair condition. The HVAC system component in need of immediate repair is listed in the following table, with the repair cost.

HVAC System No.	HVAC System Type	Description of HVAC System Component for Repair	Repair Cost ($)
ACCU-1	Air Cooled Condensing Unit	ACCU condenser coil fins are damaged; clean and repair coil fins, provide protective screen over coil fins	797

4.4.3 Proposed HVAC System Replacement

The HVAC system serving building 313 is not recommended for replacement.

4.4.4 Recommendations

The HVAC system component for repair is recommended.

4.5 BUILDING 500 (POST HEADQUARTERS)

4.5.1 HVAC System Existing Conditions

Building 500 is a 65,450 sq ft, three-story building with a conditioned basement. It was constructed during the early 1900s and has sandstone block foundations and walls. The building has administrative offices throughout, with a small video communications center. The building is served by water source heat pumps that provide heating and cooling throughout (except the video communications center which has a separate HVAC system).

The heat pump system description is similar to Building 200. The problems encountered with this system are also similar to Building 200. See Section 4.1.1 for detailed information on the heat pump system existing conditions.

4.5.2 HVAC System Components for Repair

The HVAC system components were observed to be in good condition and operating at the time of the field survey.

4.5.3 Proposed HVAC System Replacement

The existing heat pump system was installed 9 years ago, and was not considered for a replacement HVAC system.

4.5.4 Recommendations

The problems associated with the water source heat pump system can be grouped into three categories:

- Misuse of the water source heat pumps by building users.
- Intensive maintenance required for water source heat pump system operation.
- Lack of system controls to maintain proper water source heat pump system operation.

The water source heat pump system problems could be alleviated by implementing the following:

- Provide building user training for heat pump operation.
- Continue regular maintenance and replace failed heat pumps with quality heat pumps.

- Install DDC system controls to monitor water source heat pump system operation and water source temperature, and provide alarms to indicate when the system shuts down or when the water source temperature is out of proper range. Additionally, automatic control valves could be installed at strategic locations on the condenser water piping. If a break occurs in the condenser water piping system, the control valves would close automatically and retain most of the propylene-water mixture.

The water source heat pump system is being evaluated to be upgraded with DDC controls as part of the installation of a UMCS.

4.6 BUILDING 509 (ADMINISTRATION GENERAL PURPOSE)

4.6.1 HVAC System Existing Conditions

Building 509 is a 10,110 sq ft, two-story building with a conditioned basement. It was constructed during the early 1900s and has sandstone block foundations and walls. The building has administrative offices throughout, and is served by water source heat pumps that provide heating and cooling.

The heat pump system description is similar to Building 200. The problems encountered with this system are also similar to Building 200. See Section 4.1.1 for detailed information on the heat pump system existing conditions.

4.6.2 HVAC System Components for Repair

The HVAC system components were observed to be in good condition and operating at the time of the field survey.

4.6.3 Proposed HVAC System Replacement

The existing heat pump system was installed 9 years ago, and was not considered for a replacement HVAC system.

4.6.4 Recommendations

The problems associated with the water source heat pump system can be grouped into three categories:

- Misuse of the water source heat pumps by building users.
- Intensive maintenance required for water source heat pump system operation.
- Lack of system controls to maintain proper water source heat pump system operation.

The water source heat pump system problems could be alleviated by implementing the following:

- Provide building user training for heat pump operation.
- Continue regular maintenance and replace failed heat pumps with quality heat pumps.

- Install DDC system controls to monitor water source heat pump system operation and water source temperature, and provide alarms to indicate when the system shuts down or when the water source temperature is out of proper range. Additionally, automatic control valves could be installed at strategic locations on the condenser water piping. If a break occurs in the condenser water piping system, the control valves would close automatically and retain most of the propylene-water mixture.

The water source heat pump system is being evaluated to be upgraded with DDC controls as part of the installation of a UMCS.

4.7 BUILDING 5000 (FIRE STATION)

4.7.1 HVAC System Existing Conditions

Building 5000 is a 8,400 sq ft, one-story building constructed in 1975. A new 2,720 sq ft addition is currently being built. The new addition will facilitate the handling of hazardous materials. This study is concerned only with the upgrade of HVAC systems in the original building. The original building is divided into two functional areas, an administrative office/living quarters area (4,600 sq ft) and a vehicle maintenance bay area (3,800 sq ft).

The following table describes the HVAC equipment, serving Building 5000.

HVAC System No.	HVAC System Type	Description of HVAC System	Existing Condition
AHU-1	MZ	5 zone MZ serves the admin. office/living quarters area; 4,155 cfm at 5 hp	Fair condition
AHU-2	H&V	H&V serves the vehicle maintenance bay; 3,840 cfm at 1.5 hp	Fair condition
RAD-1	Infrared Radiant Heater (gas-fired)	Two IR heaters serve the vehicle maintenance bay.	Good condition
ACCU-1	Air Cooled Condensing Unit	10 Ton ACCU serves AHU-1 DX coil	Poor condition (per interview with maintenance personnel)
BLR-1	HW Boiler	600,000 BTUH (output) Boiler serves AHU-1 and AHU-2	Poor condition - rust and corrosion, leaky
HWP-1	HW pump	1/6 hp pump serves BLR-1, AHU-1, and AHU-2	Fair condition

4.7.2 HVAC System Components for Repair

The HVAC system components were observed to be generally in fair condition.

The chiller, although appearing to be in fair condition, has had mechanical problems. An interview with maintenance personnel revealed that the original ACCU (15 ton capacity) was replaced with the current ACCU (10 ton capacity). The 10 ton ACCU runs continuously during peak cooling load conditions and appears to be undersized. The increased run time hours for the ACCU have increased the amount of maintenance and repair generally required for this type of equipment. The ACCU is recommended for replacement, not repair.

The boiler has leaky front and rear head plates. The leaking has caused rust and corrosion on the boiler steel jacket. Boiler replacement, not repair, is recommended due to the boiler age, overall condition, and interview with maintenance personnel.

4.7.3 Proposed HVAC System Replacement

The ACCU, HW boiler, and MZ AHU serving Building 5000 were considered for replacement.

The MZ AHU will be replaced with three furnace-air conditioning units with DX cooling coils. The supply air ductwork will be modified to serve three zones instead of the existing five zones. The new zones will include:

- Zone 1 - Exterior perimeter zone along the south wall and half of west wall (Office area and bedroom area).
- Zone 2 - Exterior perimeter zone along the north wall and half of west wall (Dayroom and kitchen area).
- Zone 3 - Interior zone (Communications center, laboratory-storage area, and toilets).

The existing ACCU will be replaced with three ACCUs each serving the furnace-air conditioning units. ACCU-1 (serving Zone 1) will have a capacity of 5 tons. ACCU-2 (serving Zone 2) will have a capacity of 6 tons. ACCU-3 (serving Zone 3) will have a capacity of 4 tons.

The existing boiler will be replaced with a small modular boiler and will serve the H&V Unit only. The new boiler will have a output capacity of 325,000 Btuh and a minimum efficiency of 85%. The HW pump will be down-sized, and pump motor will be approximately 1/3 hp.

The H&V Unit serving the vehicle maintenance bay was not considered for replacement. The vehicle maintenance bay is heated by gas-fired IR heaters also, and the H&V Unit is used intermittently.

Method of Analysis

The approach used for calculating energy savings included using the EZDOE computer program to simulate the area of Building 5000 served by the MZ AHU. The analysis proceeded as follows:

- A baseline computer model was developed for the area of Building 5000 served by the MZ AHU. The area was divided into three zones, two perimeter zones and one interior zone.
- The baseline computer model was modified to include the HVAC replacement system - the furnace air conditioning systems. The modified baseline is the ECO model. The ECO model included additional modifications as follows:
  - The MZ AHU (4,155 cfm, 233,300 Btuh heating coil, and 120,000 Btuh cooling coil) was replaced with three furnace air conditioners, each serving one of

three zones; Zone 1 - 2,300 cfm, 80,000 Btuh furnace, and 60,000 Btuh DX coil; Zone 2 - 2,900 cfm, 100,000 Btuh furnace, and 72,000 Btuh DX coil; and Zone 3 - 1,700 cfm, 60,000 Btuh furnace, and 48,000 Btuh DX coil.

  - Combustion efficiencies for the pulse-combustion type furnaces were input at 94%.

  - The MZ AHU design OA of 1,450 cfm was reduced to a total OA quantity of 525 cfm for all three furnace air conditioners (200 cfm for Zone 1; 150 cfm for Zone 2; and 175 cfm for Zone 3). Total occupancy for all zones is approximately 15 people.

  - Combustion efficiencies for a smaller HW boiler were input at 85%.

- The ECO model energy use was subtracted from the baseline energy use to find the energy savings for natural gas and electricity.

- A construction cost was developed for the proposed HVAC system replacement.

- The energy savings and the construction cost were entered into a LCCA worksheet. Additional information entered into the LCCA worksheet included the following:

  - Economic life is 20 years.

  - Annual maintenance costs were calculated using estimated labor hours and materials.

  - Avoided cost of existing system replacement was included as a non-recurring fifth year cost.

Energy Savings and Economic Analysis

The energy savings and economic analysis for the proposed HVAC system replacements are included in Appendix D. The results of the analysis are presented in the following table.

Item	HVAC System Replacement Energy Savings and Economics
Annual Electric Energy Savings (kWh)	82
Annual Electric Demand Savings ($)	(47)
Annual Natural Gas Savings (MBtu)	196
Total Annual Energy Cost Savings	$1,752
Investment Cost	$41,284
Annual Maintenance Cost Savings	$652
Non-recurring Cost Savings	$72,986
Savings-to-Investment Ratio (SIR)	2.48
Simple Payback (yrs)	6.82

4.7.4 Recommendations

The proposed HVAC system replacement is recommended.

4.8 BUILDING 7178 (VEHICLE MAINTENANCE ADMINISTRATION)

4.8.1 HVAC System Existing Conditions

Building 7178 is a 2,480 sq ft, one-story, single room building. The building was built in the mid-1970s, using concrete block construction. The building has an administrative office area and a work bench area, all in one open room without dividing walls.

The following table describes the HVAC equipment, serving Building 7178.

HVAC System No.	HVAC System Type	Description of HVAC System	Existing Condition
UH-1	Gas-fired Unit Heater	Gas-fired UH provides heating for the northside of the building.	Good condition
UH-1	Gas-fired Unit Heater	Gas-fired UH provides heating for the southside of the building.	Good condition
WAC-1, WAC-2, WAC-3	Window Air Conditioning Unit	Three WACs serve the entire building; they are mounted in the south wall window openings (250 cfm each)	Fair condition

4.8.2 HVAC System Components for Repair

The HVAC system components were observed to be in fair to good condition and are not in need of repair.

4.8.3 Proposed HVAC System Replacement

The three WACs serving Building 7178 were considered for replacement. The WACs will be replaced with a cooling-only SZ AHU with DX coil. The SZ AHU will be installed (ceiling-mounted) at the center of south wall. A supply air ductwork will be run straight out from the SZ AHU at the center of the building. Supply grilles will be connected directly to the supply air ductwork. An ACCU will be installed on the roof directly above the SZ AHU.

Method of Analysis

The approach used for calculating energy savings included using a computer program to simulate a typical building. The EZDOE computer model for Building 7243 HVAC system replacement was used to evaluate the energy savings. The HVAC system replacement for Building 7178 is similar to Building 7243. The energy savings from Building 7243 were prorated on a square foot basis to Building 7178.

The analysis proceeded as follows:

- A construction cost was developed for the proposed HVAC system replacement.

- The energy savings and the construction cost were entered into a LCCA worksheet. Additional information entered into the LCCA worksheet included the following:

  - Economic life is 20 years.

  - Annual maintenance costs were calculated using estimated labor hours and materials.

  - Avoided cost of existing system replacement was included as a non-recurring fifth year cost.

Energy Savings and Economic Analysis

The energy savings and economic analysis for the proposed HVAC system replacement are included in Appendix D. The results of the analysis are presented in the following table.

Item	HVAC System Replacement Energy Savings and Economics
Annual Electric Energy Savings (MBtu)	52
Annual Electric Demand Savings ($)	826
Annual Natural Gas Savings (MBtu)	0
Total Annual Energy Cost Savings	$1,454
Investment Cost	$12,511
Annual Maintenance Cost Savings	($141)
Non-recurring Cost Savings	$4,071
Savings-to-Investment Ratio (SIR)	1.89
Simple Payback (yrs)	8.25

4.8.4 Recommendations

The proposed HVAC system replacement is not recommended.

4.9 BUILDING 7636 (REGIMENTAL HEADQUARTERS)

4.9.1 HVAC System Existing Conditions

Building 7636 is a 9,850 sq ft, two-story building with a conditioned basement. The building was built in the mid-1970's, constructed of face brick and concrete block. The building has administrative offices throughout, with a conference room in the basement.

The following table describes the HVAC equipment serving Building 7636.

HVAC System No.	HVAC System Type	Description of HVAC System	Existing Condition
FC-1 through FC-25	Fan Coil Unit	Dual temperature FCs provide heating and cooling. FCs are located along the building perimeter on the basement, 1st, and 2nd floors.	Fair condition
AHU-1	SZ	SZ AHU with combination heating/cooling coil provides fresh air to the interior zones of the building on the basement, 1st, and 2nd floors	Fair condition
RAD-1	Finned tube baseboard radiation	Finned tube baseboard radiation provides heat to entry ways, stairwells, and a storage area in the basement	Fair condition
BLR-1	HW Boiler	360,000 BTUH (output) boiler serves FCs, AHU-1, and RAD-1. 2-1/2" HW temperature control valve (3-way) is leaking, has corroded actuator.	Fair condition 3-way Control Valve - poor condition
HWP-1	HW Pump	3/4 hp HW pump serves finned tube baseboard radiation system.	HW pump - fair condition
CH-1	Reciprocating w/ Air Cooled Cond.	Chiller serves the FCs and AHU-1	Fair condition
CWP-1	CW Pump	5 hp CW pump serves the FCs and AHU-1	Fair condition

4.9.2 HVAC System Components for Repair

The HVAC system components were observed to be in fair condition. The HVAC system component in need of immediate repair is listed in the following table, with the repair cost.

HVAC System No.	HVAC System Type	Description of HVAC System Component for Repair	Repair Cost ($)
BLR-1	HW Boiler	3-way control valve on the HW system is disabled; replace 2-1/2" three-way control valve	1,050

4.9.3 Proposed HVAC System Replacement

The HVAC systems in Building 7636 are not recommended for replacement.

4.9.4 Recommendations

The HVAC system component for repair is recommended.

4.10 BUILDING 8056 (DET DAY ROOM)

4.10.1 HVAC System Existing Conditions

Building 8056 is a 2,100 sq ft, one-story building. The building was constructed in the mid-1970's using face brick and concrete block. The building has two small administration offices, a mail distribution area, a game room, a televison viewing room, two latrines, and two storage closets.

The following table describes the HVAC equipment serving Building 8056.

HVAC System No.	HVAC System Type	Description of HVAC System	Existing Condition
AHU-1	SZ	SZ AHU with steam heating coil and chilled water cooling coil serves the entire building (2,770 cfm at 1-1/2 hp)	Fair condition
CDP-1	Steam condensate pump	3/4 hp condensate pump - pumps condensate from SZ AHU to steam condensate piping system.	Poor condition - does not operate
	Steam and Chilled Water	Steam is provided by a Central Boiler Plant; Chilled Water is provided by a Central Chiller Plant	

4.10.2 HVAC System Components for Repair

The HVAC system components were observed to be in fair to poor condition. The HVAC system component in need of immediate repair is listed in the following table, with the repair cost.

HVAC System No.	HVAC System Type	Description of HVAC System Component for Repair	Repair Cost ($)
CDP-1	Steam condensate pump	3/4 hp condensate pump does not operate; replace pump and motor	744

4.10.3 Proposed HVAC System Replacement

The HVAC system was not considered for replacement.

4.10.4 Recommendations

The HVAC system component for repair is recommended.

4.11 BUILDING 7243 (ADMINISTRATION AND SUPPLY)

4.11.1 HVAC System Existing Conditions

Building 7243 is a 17,830 sq ft, one-story building. The original building (13,030 sq ft), built in 1958, is constructed of face brick and concrete block. A 4,800 sq ft addition was added in 1982 using similar construction materials. The building is divided into six company administration and supply units, each one being identical except for the addition.

The entire original building is heated by perimeter radiation. The original building administration areas are cooled by WACs. The original building supply areas have ventilation exhaust fans, and do not have cooling. The addition administration areas are heated and cooled by FC units. The addition supply area is heated by a H&V unit and a UH.

The following table describes the HVAC equipment serving Building 7243.

HVAC System No.	HVAC System Type	Description of HVAC System	Existing Condition
RAD-1	Perimeter radiation	Perimeter radiation provides heating in all areas of the original building	Fair condition
WAC-1 through WAC-15	Window Air Conditioning Unit	Fifteen WACs serve the original building administration areas (three per area); they are mounted in the north wall window openings; approx. 250 cfm each	Fair condition
EF-1 through EF-5	Exhaust Fan	Five EFs serve the supply areas of the original building to provide ventilation air	Fair condition
FC-1 through FC-4	Two-pipe fan coil	Four dual-temperature FCs provide heating and cooling to the addition administration area.	Fair condition
H&V-1	H&V Unit	One H&V Unit provides heating to the addition supply area	Fair condition
UH-1	Unit Heater	Unit heater provides heating in storage room of addition supply area	Fair condition
BLR-1	HW Boiler	850,000 BTUH (output) boiler serves RAD-1, FCs, H&V-1, and UH-1.	Good condition
HWP-1	HW pump	1/2 hp pump serves RAD-1	Good condition
HWP-2	HW pump	1/2 hp pump serves H&V-1 and UH-1	Good condition
CWP-1	CW pump	1/2 hp pump serves Fcs; Central chiller plant is the source of chilled water for cooling.	Fair condition

4.11.2 HVAC System Components for Repair

The HVAC system components were observed to be in fair condition and are not in need of repair.

4.11.3 Proposed HVAC System Replacement

The fifteen WACs serving the administration office areas of the original building were considered to be replaced with five SZ AHUs with cooling coils (cooling only), each serving one of five zones. The five zones are the five administration areas in the original building. The following HVAC equipment, materials, and labor will be included in the system replacement:

- SZ AHUs will be installed (floor-mounted) in the supply area.
- Supply air and return air ductwork will be installed to serve the office areas.
- OA ductwork will be installed to provide outside air to the SZ AHUs.
- CW supply and return piping will be routed to each SZ AHU.

Method of Analysis

The approach used for calculating energy savings included using a computer program to simulate a typical building. The EZDOE computer model for Building 8021 was used to evaluate energy savings for the proposed HVAC system replacement. Building 8021 is similar to Building 7243 except for the HVAC system. The analysis proceeded as follows:

- The computer model for Building 8021 was modified to include the existing WACs that provide cooling only; this model was used as the baseline computer model for Building 7243. The baseline model included the following parameters for the WACs:
  - Cooling EIR is 73%;
  - Supply air volume is 3,750 cfm.
- The baseline computer model was modified to include the proposed HVAC system replacement - SZ AHUs. The OA and infiltration rates were not changed. The modified baseline is the ECO model. The ECO model included additional modifications as follows:
  - Mechanical effeciency is 85%;
  - Supply air volume is 5,000 cfm;

- Chilled water is supplied by a central chiller plant.

- The ECO model energy use was subtracted from the baseline energy use to find the energy savings for natural gas and electricity.

- A construction cost was developed for the proposed HVAC system replacement.

- The energy savings and the construction cost were entered into a LCCA worksheet. Additional information entered into the LCCA worksheet included the following:

  - Economic life is 20 years.

  - Annual maintenance costs were calculated using estimated labor hours and materials.

  - Avoided cost of existing system replacement was included as a non-recurring fifth year cost.

Energy Savings and Economic Analysis

The energy savings and economic analysis for the proposed HVAC system replacement are included in Appendix D. The results of the analysis are presented in the following table.

Item	HVAC System Replacement Energy Savings and Economics
Annual Electric Energy Savings (MBtu)	50
Annual Electric Demand Savings ($)	790
Annual Natural Gas Savings (MBtu)	0
Total Annual Energy Cost Savings	$1,390
Investment Cost	$43,596
Annual Maintenance Cost Savings	($704)
Non-recurring Cost Savings	$19,638
Savings-to-Investment Ratio (SIR)	0.64
Simple Payback (yrs)	26.13

4.11.4 Recommendations

The HVAC systems are not recommended for replacement or repair.

4.12 BUILDING 7432 (ADMINISTRATION AND SUPPLY)

4.12.1 HVAC System Existing Conditions

Building 7432 is a 23,680 sq ft, one-story building. The building was built in 1986 and is constructed of face brick and concrete block. The building is divided into five company administration and supply units, each one being identical. The administration areas are heated and cooled by FCs. The building supply areas are heated by H&V units.

The following table describes the HVAC equipment serving Building 7432.

HVAC System No.	HVAC System Type	Description of HVAC System	Existing Condition
FC-1 through FC-20	Two-pipe fan coil	Four dual-temperature FCs provide heating and cooling to each of the administration areas; there are a total of 20 FCs serving the building.	Good condition
H&V-1	H&V Unit	One H&V Unit provides heating to each of the supply areas; there are a total of 5 H&Vs serving the building.	Good condition
CH-1	Reciprocating w/ Air Cooled Cond.	20 Ton chiller serves FCs	Good condition
BLR-1	HW Boiler	895,000 BTUH (output) boiler serves FCs and H&Vs	Good condition
HWP-1	HW pump	5 hp pump serves BLR-1, FCs, and H&Vs	Fair condition
CWP-1	CW pump	3 hp pump serves CH-1 and FCs	Good condition

4.12.2 HVAC System Components for Repair

The HVAC system components were observed to be in fair condition and are not in need of repair.

4.12.3 Proposed HVAC System Replacement

The HVAC systems in Building 7432 were not considered for replacement.

4.12.4 Recommendations

The HVAC system is not recommended for repair or replacement.

4.13 BUILDING 7602 (ADMINISTRATION AND SUPPLY)

4.13.1 HVAC System Existing Conditions

Building 7602 is a 13,520 sq ft, one-story building. The building was built in 1958 and is constructed of face brick and concrete block. The building is divided into five company administration and supply units, each one being identical.

The administration areas are cooled by small SZ AHUs. The entire building is heated by perimeter radiation units. The following table describes the HVAC equipment serving Building 7602.

HVAC System No.	HVAC System Type	Description of HVAC System	Existing Condition
RAD-1	Perimeter radiation	Perimeter radiation provides heating in all areas of the building	Fair condition
AHU-1 through AHU-5	SZ	Five SZ AHUs with cooling coils serve the administration office areas of the building (940 cfm at 1/2 hp)	Poor condition - cooling coils and piping at coils are damaged and leaking
CH-1	Reciprocating w/ Air Cooled Cond.	15 Ton chiller serves SZ AHUs	Fair condition
BLR-1	HW Boiler	800,000 BTUH (output) boiler serves RAD-1	Fair condition
HWP-1	HW pump	3/4 hp pump serves BLR-1 and RAD-1	Fair condition
CWP-1	CW pump	1 hp pump serves CH-1 and SZ AHUs	Fair condition

4.13.2 HVAC System Components for Repair

The HVAC system components for RAD-1, CH-1, BLR-1, HWP-1, and CWP-1 were observed to be in fair condition and are not in need of repair. The SZ AHUs were observed to be generally in poor condition. The HVAC system components in need of immediate repair are listed in the following table, with the repair cost.

HVAC System No.	HVAC System Type	Description of HVAC System Component for Repair	Repair Cost ($)
AHU-1 through AHU-5	SZ AHU	Chilled water cooling coils are damaged and leaky; replace five - 2 row, 30"x 30" cooling coils	3,077
AHU-1 through AHU-5	SZ AHU	Chilled water cooling coil piping is leaky; replace approx. 90 ft. of 1.25" piping and pipe insulation	837
		Total Repair Cost	3,914

4.13.3 Proposed HVAC System Replacement

The SZ AHUs serving the administration areas of Building 7602 were considered for replacement. The SZ AHUs will be replaced with energy efficient SZ AHUs. The following HVAC equipment, materials, and labor will be included in the system replacement:

- SZ AHU.

- Electric thermostat to cycle SZ AHU supply fan.

- Flushing out of existing CW piping system to remove sludge build-up.

Method of Analysis

The approach used for calculating energy savings included using a computer program to simulate a typical building. The EZDOE computer model for Building 8021 was used to evaluate energy savings for the proposed HVAC system replacement. Building 8021 is similar to Building 7602 except for the HVAC system. The analysis proceeded as follows:

- The computer model for Building 8021 was modified to include the existing cooling-only SZ AHUs; this model was used as the baseline computer model for Building 7602. The baseline model included the following parameters for the SZ AHUs:

  - SZ AHU fans run continuously.

  - Mechanical effeciency is 75%.

  - Supply air volume is 4,700 cfm.

- The baseline computer model was modified to include the proposed HVAC system replacement - SZ AHUs. The modified baseline is the ECO model. The ECO model included additional modifications as follows:

  - SZ AHU fans are cycled on as needed.

  - Mechanical effeciency is 85%.

  - Supply air volume is 5,000 cfm.

- The ECO model energy use was subtracted from the baseline energy use to find the energy savings for natural gas and electricity.

- A construction cost was developed for the proposed HVAC system replacement.

- The energy savings and the construction cost were entered into a LCCA worksheet. Additional information entered into the LCCA worksheet included the following:

  - Economic life is 20 years.

  - Annual maintenance costs were calculated using estimated labor hours and materials.

  - Avoided cost of existing system replacement was included as a non-recurring fifth year cost.

Energy Savings and Economic Analysis

The energy savings and economic analysis for the proposed HVAC system replacement are included in Appendix D. The results of the analysis are presented in the following table.

Item	HVAC System Replacement Energy Savings and Economics
Annual Electric Energy Savings (MBtu)	25
Annual Electric Demand Savings ($)	213
Annual Natural Gas Savings (MBtu)	0
Total Annual Energy Cost Savings	$515
Investment Cost	$24,083
Annual Maintenance Cost Savings	$0
Non-recurring Cost Savings	$20,550
Savings-to-Investment Ratio (SIR)	1.07
Simple Payback (yrs)	15.62

4.13.4 Recommendations

The HVAC system components for repair are recommended.

4.14 BUILDING 7608 (ADMINISTRATION AND SUPPLY)

4.14.1 HVAC System Existing Conditions

Building 7608 is a 13,520 sq ft, one-story building. The building was built in 1958 and is constructed of face brick and concrete block. The building is divided into five company administration and supply units, each one being identical. The administration areas are cooled by small SZ AHUs. The entire building is heated by perimeter radiation units.

The following table describes the HVAC equipment serving Building 7608.

HVAC System No.	HVAC System Type	Description of HVAC System	Existing Condition
RAD-1	Perimeter radiation	Perimeter radiation provides heating in all areas of the building	Fair condition
AHU-1 through AHU-5	SZ	Five SZ AHUs with cooling coils serve the administration office areas of the building (940 cfm at 1/2 hp)	Poor condition - cooling coils and piping at coils are damaged and leaking
CH-1	Reciprocating w/ Air Cooled Cond.	15 Ton chiller serves SZ AHUs	Fair condition
BLR-1	HW Boiler	800,000 BTUH (output) boiler serves RAD-1	Fair condition
HWP-1	HW pump	3/4 hp pump serves BLR-1 and RAD-1	Fair condition
CWP-1	CW pump	1 hp pump serves CH-1 and SZ AHUs	Fair condition

4.14.2 HVAC System Components for Repair

The HVAC system components for RAD-1, CH-1, BLR-1, HWP-1, and CWP-1 were observed to be in fair condition and are not in need of repair. The SZ AHUs were observed to be generally in poor condition. The HVAC system components in need of immediate repair are listed in the following table, with the repair cost.

HVAC System No.	HVAC System Type	Description of HVAC System Component for Repair	Repair Cost ($)
AHU-1 through AHU-5	SZ AHU	Chilled water cooling coils are damaged and leaky; replace five - 2 row, 30"x 30" cooling coils	3,077
AHU-1 through AHU-5	SZ AHU	Chilled water cooling coil piping is leaky; replace approx. 90 ft. of 1.25" piping and pipe insulation	837
		Total Repair Cost	3,914

4.14.3 Proposed HVAC System Replacement

The SZ AHUs serving the administration areas of Building 7608 were considered for replacement. The SZ AHUs will be replaced with energy efficient SZ AHUs.

Method of Analysis

The approach used for calculating energy savings included using a computer program to simulate a typical building. The EZDOE computer model for Building 8021 was used to evaluate energy savings for the proposed HVAC system replacement. Building 8021 is similar to Building 7608. The analysis, energy savings, and system replacement cost for Building 7608 are taken from Building 7602. Building 7602 is identical to Building 7608.

Energy Savings and Economic Analysis

The energy savings and economic analysis for the proposed HVAC system replacement are included in Appendix D. The results of the analysis are presented in the following table.

Item	HVAC System Replacement Energy Savings and Economics
Annual Electric Energy Savings (MBtu)	25
Annual Electric Demand Savings ($)	213
Annual Natural Gas Savings (MBtu)	0
Total Annual Energy Cost Savings	$515
Investment Cost	$24,083
Annual Maintenance Cost Savings	$0
Non-recurring Cost Savings	$20,550
Savings-to-Investment Ratio (SIR)	1.07
Simple Payback (yrs)	15.62

4.14.4 Recommendations

The HVAC system components for repair are recommended.

4.15 BUILDING 7652 (ADMINISTRATION AND SUPPLY)

4.15.1 HVAC System Existing Conditions

Building 7652 is a 13,520 sq ft, one-story building. The building was built in 1958 and is constructed of face brick and concrete block. The building is divided into five company administration and supply units, each one being identical. The administration areas are cooled by small SZ AHUs. The entire building is heated by perimeter radiation units.

The following table describes the HVAC equipment serving Building 7652.

HVAC System No.	HVAC System Type	Description of HVAC System	Existing Condition
RAD-1	Perimeter radiation	Perimeter radiation provides heating in all areas of the building	Fair condition
AHU-1 through AHU-5	SZ	Five SZ AHUs with cooling coils serve the administration office areas of the building (940 cfm at 1/2 hp)	Poor condition - cooling coils and piping at coils are damaged and leaking
CH-1	Reciprocating w/ Air Cooled Cond.	15 Ton chiller serves SZ AHUs	Good condition
BLR-1	HW Boiler	800,000 BTUH (output) boiler serves RAD-1	Fair condition
HWP-1	HW pump	3/4 hp pump serves BLR-1 and RAD-1	Fair condition
CWP-1	CW pump	1 hp pump serves CH-1 and SZ AHUs	Fair condition

4.15.2 HVAC System Components for Repair

The HVAC system components for RAD-1, CH-1, BLR-1, HWP-1, and CWP-1 were observed to be in fair condition and are not in need of repair. The SZ AHUs were observed to be generally in poor condition. The HVAC system components in need of immediate repair are listed in the following table, with the repair cost.

HVAC System No.	HVAC System Type	Description of HVAC System Component for Repair	Repair Cost ($)
AHU-1 through AHU-5	SZ AHU	Chilled water cooling coils are damaged and leaky; replace five - 2 row, 30"x 30" cooling coils	3,077
AHU-1 through AHU-5	SZ AHU	Chilled water cooling coil piping is leaky; replace approx. 90 ft. of 1.25" piping and pipe insulation	837
		Total Repair Cost	3,914

4.15.3 Proposed HVAC System Replacement

The SZ AHUs serving the administration areas of building 7652 were considered for replacement. The SZ AHUs will be replaced with energy efficient SZ AHUs.

Method of Analysis

The approach used for calculating energy savings included using a computer program to simulate a typical building. The EZDOE computer model for Building 8021 was used to evaluate energy savings for the proposed HVAC system replacement. Building 8021 is similar to Building 7608. The analysis, energy savings, and system replacement cost for Building 7652 are taken from Building 7602. Building 7602 is identical to Building 7652.

Energy Savings and Economic Analysis

The energy savings and economic analysis for the proposed HVAC system replacement are included in Appendix D. The results of the analysis are presented in the following table.

Item	HVAC System Replacement Energy Savings and Economics
Annual Electric Energy Savings (MBtu)	25
Annual Electric Demand Savings ($)	213
Annual Natural Gas Savings (MBtu)	0
Total Annual Energy Cost Savings	$515
Investment Cost	$24,083
Annual Maintenance Cost Savings	$0
Non-recurring Cost Savings	$20,550
Savings-to-Investment Ratio (SIR)	1.07
Simple Payback (yrs)	15.62

4.15.4 Recommendations

The HVAC system components for repair are recommended.

4.16 BUILDING 7658 (ADMINISTRATION AND SUPPLY)

4.16.1 HVAC System Existing Conditions

Building 7658 is a 13,520 sq ft, one-story building. The building was built in 1958 and is constructed of face brick and concrete block. The building is divided into five company administration and supply units, each one being identical. The administration areas are cooled by small SZ AHUs. The entire building is heated by perimeter radiation units.

The following table describes the HVAC equipment serving Building 7658.

HVAC System No.	HVAC System Type	Description of HVAC System	Existing Condition
RAD-1	Perimeter radiation	Perimeter radiation provides heating in all areas of the building	Fair condition
AHU-1 through AHU-5	SZ	Five SZ AHUs with cooling coils serve the administration office areas of the building (940 cfm at 1/2 hp)	Poor condition - cooling coils and piping at coils are damaged and leaking
CH-1	Reciprocating w/ Air Cooled Cond.	15 Ton chiller serves SZ AHUs	Good condition
BLR-1	HW Boiler	800,000 BTUH (output) boiler serves RAD-1	Fair condition
HWP-1	HW pump	3/4 hp pump serves BLR-1 and RAD-1	Fair condition
CWP-1	CW pump	1 hp pump serves CH-1 and SZ AHUs	Fair condition

4.16.2 HVAC System Components for Repair

The HVAC system components for RAD-1, CH-1, BLR-1, HWP-1, and CWP-1 were observed to be in fair condition and are not in need of repair. The SZ AHUs were observed to be generally in poor condition. The HVAC system components in need of immediate repair are listed in the following table, with the repair cost.

HVAC System No.	HVAC System Type	Description of HVAC System Component for Repair	Repair Cost ($)
AHU-1 through AHU-5	SZ AHU	Chilled water cooling coils are damaged and leaky; replace five - 2 row, 30"x 30" cooling coils	3,077
AHU-1 through AHU-5	SZ AHU	Chilled water cooling coil piping is leaky; replace approx. 90 ft. of 1.25" piping and pipe insulation	837
		Total Repair Cost	3,914

4.16.3 Proposed HVAC System Replacement

The SZ AHUs serving the administration areas of building 7658 were considered for replacement. The SZ AHUs will be replaced with energy efficient SZ AHUs.

Method of Analysis

The approach used for calculating energy savings included using a computer program to simulate a typical building. The EZDOE computer model for Building 8021 was used to evaluate energy savings for the proposed HVAC system replacement. Building 8021 is similar to Building 7658. The analysis, energy savings, and system replacement cost for Building 7658 are taken from Building 7602. Building 7602 is identical to Building 7658.

Energy Savings and Economic Analysis

The energy savings and economic analysis for the proposed HVAC system replacement are included in Appendix D. The results of the analysis are presented in the following table.

Item	HVAC System Replacement Energy Savings and Economics
Annual Electric Energy Savings (MBtu)	25
Annual Electric Demand Savings ($)	213
Annual Natural Gas Savings (MBtu)	0
Total Annual Energy Cost Savings	$515
Investment Cost	$24,083
Annual Maintenance Cost Savings	$0
Non-recurring Cost Savings	$20,550
Savings-to-Investment Ratio (SIR)	1.07
Simple Payback (yrs)	15.62

4.16.4 Recommendations

The HVAC system components for repair are recommended.

4.17 BUILDING 8021 (ADMINISTRATION AND SUPPLY)

4.17.1 HVAC System Existing Conditions

Building 8021 is a 23,680 sq ft, one-story building. The building was built in 1975 and is constructed of face brick and concrete block. The building is divided into five company administration and supply units, each one being identical. The administration areas are heated and cooled by FCs. The supply areas of the building are heated by H&V units.

The following table describes the HVAC equipment serving Building 8021.

HVAC System No.	HVAC System Type	Description of HVAC System	Existing Condition
FC-1 through FC-20	Two-pipe fan coil	Four dual-temperature FCs provide heating and cooling to each of the administration areas; there are a total of 20 FCs serving the building; 600 cfm to 900 cfm and 1/12 hp each	Fair condition
H&V-1	H&V Unit	One H&V Unit provides heating to each of the supply areas; there are a total of 5 H&Vs serving the building; 2,400 cfm and 1/2 hp each	Fair condition
DTWP-1	Dual Temperature Water pump	2 hp DTWP serves FCs and H&Vs; Summer/Winter changeover valve switches between heating and cooling; Chilled water is provided by Central Chiller Plant	Fair condition
CV-1	Steam/HW converter	Steam/HW converter serves FCs, and H&Vs; Steam provided by Central Boiler Plant	Fair condition

4.17.2 HVAC System Components for Repair

The HVAC system components were observed to be in fair condition and are not in need of repair.

4.17.3 Proposed HVAC System Replacement

The HVAC systems in Building 8021 were not considered for replacement.

4.17.4 Recommendations

The HVAC systems are not recommended for repair or replacement.

4.18 BUILDING 8057 (ADMINISTRATION AND SUPPLY)

4.18.1 HVAC System Existing Conditions

Building 8057 is a 23,680 sq ft, one-story building. The building was built in 1975 and is constructed of face brick and concrete block. The building is divided into five company administration and supply units, each one being identical. The administration areas are heated and cooled by FCs. The supply areas of the building are heated by H&V units.

The following table describes the HVAC equipment serving Building 8057.

HVAC System No.	HVAC System Type	Description of HVAC System	Existing Condition
FC-1 through FC-20	Two-pipe fan coil	Four dual-temperature FCs provide heating and cooling to each of the administration areas; there are a total of 20 FCs serving the building; 600 cfm to 900 cfm and 1/12 hp each	Fair condition
H&V-1	H&V Unit	One H&V Unit provides heating to each of the supply areas; there are a total of 5 H&Vs serving the building; 2,400 cfm and 1/2 hp each	Fair condition
DTWP-1	Dual Temperature Water pump	2 hp DTWP serves FCs and H&Vs; Summer/Winter changeover valve switches between heating and cooling; Chilled water is provided by Central Chiller Plant	Fair condition
CV-1	Steam/HW converter	Steam/HW converter serves FCs, and H&Vs; Steam provided by Central Boiler Plant	Fair condition

4.18.2 HVAC System Components for Repair

The HVAC system components were observed to be in fair condition and are not in need of repair.

4.18.3 Proposed HVAC System Replacement

The HVAC systems in Building 8057 were not considered for replacement.

4.18.4 Recommendations

The HVAC systems are not recommended for repair or replacement.

4.19 BUILDING 227 (ENLISTED BARRACKS W/AS)

4.19.1 HVAC System Existing Conditions

Building 227 is a 32,300 sq ft, two-story building with a conditioned basement. It was constructed during the early 1900's and has sandstone block foundations and walls. This barracks has dormitory rooms on the first and second floors, and a recreation room, laundry facility, and storage area in the basement. The majority of the building is served by MZ AHUs and SZ AHUs, installed in 1975, that provide heating and cooling. Part of the basement is heated by unit heaters, and the vestibules and stairwells are heated by finned tube radiation units.

The following table describes the HVAC equipment serving Building 227.

HVAC System No.	HVAC System Type	Description of HVAC System	Existing Condition
AHU-1	MZ	MZ AHU serves the east half of the first and second floors of the building; 10,350 cfm at 5 hp	Fair condition
AHU-2	MZ	MZ AHU serves the west half of the first and second floors of the building; 10,250 cfm at 5 hp	Fair condition
AHU-3	SZ	SZ AHU serves the west wing of the basement; 2,800 cfm at 1 hp	Poor condition - 1" CW control valve inoperable
AHU-4	SZ	SZ AHU serves the central area of the basement; 930 cfm at 1 hp	Fair condition
AHU-5	SZ	SZ AHU serves the east wing of the basement; 2,400 cfm at 1 hp	Poor condition - 1-1/2" CW control valve actuator missing
RAD-1	Finned tube radiation	Finned tube radiation provides heating in the vestibules and stairwells	Fair condition
UH-1 and UH-2	Unit Heaters	UH-1 and UH-2 provide heat to storage areas in the basement	Fair condition
CH-1	Reciprocating w/ Air Cooled Cond.	65 Ton chiller serves the MZ and SZ AHUs	Fair condition
CWP-1	CW pump	3 hp pump serves CH-1, MZ AHUs, and SZ AHUs	Fair condition
BLR-1 and BLR-2	Steam boiler	Steam boilers serve the MZ AHUs, SZ AHUs, RAD-1, and UHs	Fair condition

4.19.2 HVAC System Components for Repair

The HVAC system components were observed to be generally in fair condition. The HVAC system components in need of immediate repair are listed in the following table, with the repair costs.

HVAC System No.	HVAC System Type	Description of HVAC System Component for Repair	Repair Cost ($)
AHU-3	SZ	1" CW control valve actuator missing - replace entire valve	206
AHU-5	SZ	1-1/2" CW control valve actuator inoperable - replace entire valve	300
		Total Repair Cost	506

4.19.3 Proposed HVAC System Replacement

The MZ AHUs and SZ AHUs serving Building 227 were considered for replacement with VAV AHUs. The following equipment and materials will be included in the proposed HVAC system replacement:

- VAV AHUs with VSDs will replace the MZ and SZ AHUs.
- Existing ductwork will remain; VAV terminal units will be installed on the zone supply air ducts.
- Thermostats will be installed in each zone; the thermostats will reset the VAV terminal unit controllers that vary the supply air to the zone.

Method of Analysis

The approach used for calculating energy savings included using a computer program to simulate a typical building. The EZDOE computer model for Building 409 (ENL Barracks) was used to evaluate energy savings for the proposed HVAC system replacement. Building 227 is similar to Building 409, and both have similar HVAC systems.

The analysis proceeded as follows:

- The computer model for Building 409 was used for the baseline computer model.
- The baseline computer model was modified to include the HVAC replacement system - the VAV AHUs with VSDs. The modified baseline is the ECO model.
- The ECO model energy use was subtracted from the baseline energy use to find the energy savings for natural gas and electricity. The energy savings were prorated on a square foot basis to Building 227.

- A construction cost was developed for the proposed HVAC system replacement.

- The energy savings and the construction cost were entered into a LCCA worksheet. Additional information entered into the LCCA worksheet included the following:

  - Economic life is 20 years.

  - Avoided cost of existing system replacement was included as a non-recurring fifth year cost.

Energy Savings and Economic Analysis

The energy savings and economic analysis for the proposed HVAC system replacement are included in Appendix D. The results of the analysis are presented in the following table.

Item	HVAC System Replacement Energy Savings and Economics
Annual Electric Energy Savings (MBtu)	1,163
Annual Electric Demand Savings ($)	1,527
Annual Natural Gas Savings (MBtu)	(852)
Total Annual Energy Cost Savings	$12,089
Investment Cost	$111,119
Annual Maintenance Cost Savings	$0
Non-recurring Cost Savings	$70,248
Savings-to-Investment Ratio (SIR)	2.18
Simple Payback (yrs)	7.12

4.19.4 Recommendations

The proposed HVAC system replacement is recommended.

4.20 BUILDING 402 (ENLISTED BARRACKS W/AS)

4.20.1 HVAC System Existing Conditions

Building 402 is a 35,700 sq ft, two-story building with a conditioned basement. It was constructed during the early 1900's and has sandstone block foundations and walls. This barracks has dormitory rooms on the first and second floors, and a recreation room, laundry facility, and storage area in the basement. The first and second floors of the building are served by MZ AHUs, installed in 1975, that provide heating and cooling. The basement is heated by finned tube radiation units, except for a SZ AHU serving the recreation room. The latrines, vestibules, and stairwells are heated by finned tube radiation units.

The following table describes the HVAC equipment serving Building 402.

HVAC System No.	HVAC System Type	Description of HVAC System	Existing Condition
AHU-1	MZ	MZ AHU serves the north half of the first and second floors of the building; 9,325 cfm at 5 hp	Fair condition
AHU-2	MZ	MZ AHU serves the south half of the first and second floors of the building; 11,800 cfm at 7.5 hp	Fair condition
AHU-3	SZ	SZ AHU serves the north wing of the basement; 1,300 cfm at 1 hp	Poor condition - 1-1/2" CW control valve inoperable
RAD-1	Finned tube radiation	Finned tube radiation provides heating in the latrines, vestibules and stairwells	Fair condition
CH-1	Reciprocating w/ Air Cooled Cond.	65 Ton chiller serves the MZ AHUs and SZ AHU	Fair condition
CWP-1	CW pump	3 hp pump serves CH-1, MZ AHUs, and SZ AHU	Fair condition
BLR-1 and BLR-2	Steam boiler	Steam boilers serve the MZ AHUs, SZ AHUs, and RAD-1	Fair condition

4.20.2 HVAC System Components for Repair

The HVAC system components were observed to be generally in fair condition. The HVAC system component in need of immediate repair is listed in the following table, with the repair cost.

HVAC System No.	HVAC System Type	Description of HVAC System Component for Repair	Repair Cost ($)
AHU-3	SZ	1-1/2 CW control valve actuator inoperable - replace entire valve	300

4.20.3 Proposed HVAC System Replacement

The MZ AHUs and SZ AHU serving Building 402 were considered for replacement with VAV AHUs with VSDs. The following equipment and materials will be included in the proposed HVAC system replacement:

- VAV AHUs with VSDs will replace the MZ AHUs and SZ AHU.
- Existing ductwork will remain; VAV terminal units (pressure independent) will be installed on the zone supply air ducts.
- Thermostats will be installed in each zone; the thermostats will reset the VAV terminal unit controllers that vary the supply air to the zone.

Method of Analysis

The approach used for calculating energy savings included using a computer program to simulate a typical building. The EZDOE computer model for Building 409 (ENL Barracks) was used to evaluate energy savings for the proposed HVAC system replacement. Building 402 is similar to Building 409, and both have similar HVAC systems. Building 402 is also similar to Building 227. The energy savings calculated for the proposed HVAC system replacement in Building 227 were prorated on a square foot basis to derive the energy savings for Building 402.

Energy Savings and Economic Analysis

The energy savings and economic analysis for the proposed HVAC system replacement are included in Appendix D. The results of the analysis are presented in the following table.

Item	HVAC System Replacement Energy Savings and Economics
Annual Electric Energy Savings (MBtu)	997
Annual Electric Demand Savings ($)	1,309
Annual Natural Gas Savings (MBtu)	(730)
Total Annual Energy Cost Savings	$10,362
Investment Cost	$78,851
Annual Maintenance Cost Savings	$0
Non-recurring Cost Savings	$49,221
Savings-to-Investment Ratio (SIR)	2.52
Simple Payback (yrs)	6.15

4.20.4 Recommendations

The proposed HVAC system replacement is recommended.

4.21 BUILDING 410 (ENLISTED BARRACKS W/AS)

4.21.1 HVAC System Existing Conditions

Building 410 is a 32,880 sq ft, two-story building with a conditioned basement. It was constructed during the early 1900s and has sandstone block foundations and walls. This barracks has dormitory rooms on the first and second floors, and a recreation room, laundry facility, and storage area in the basement. The first and second floors of the building are served by MZ AHUs that provide heating and cooling. The basement is heated by finned tube radiation units and UHs, except for a MZ AHU serving the recreation room and a meeting room. The latrines, vestibules, and stairwells are heated by finned tube radiation units. The majority of the HVAC equipment was installed in 1975.

The following table describes the HVAC equipment serving Building 410.

HVAC System No.	HVAC System Type	Description of HVAC System	Existing Condition
AHU-1	MZ	MZ AHU serves the north west half of the first and second floors of the building; 12,375 cfm at 7.5 hp	Fair condition
AHU-2	MZ	MZ AHU serves the south east half of the first and second floors of the building; 12,375 cfm at 7.5 hp	Fair condition
AHU-3	MZ	MZ AHU serves the north east wing of the basement and a meeting room; 1,950 cfm at 1 hp	Fair condition
UH-1	Unit Heater	Two UHs serve the north west wing of the basement	Fair condition
UH-2	Unit Heater	Four UHs serve the north east wing of the basement	Fair condition
RAD-1	Finned tube radiation	Finned tube radiation provides heating in the latrines, vestibules and stairwells	Fair condition
CH-1	Reciprocating w/ Air Cooled Cond.	70 Ton chiller serves the MZ AHUs and SZ AHU	Good condition (new)
CWP-1	CW pump	3 hp pump serves CH-1 and MZ AHUs	Fair condition
BLR-1	Steam boiler	Steam boiler serves the MZ AHUs, RAD-1, and UHs	Fair condition

4.21.2 HVAC System Components for Repair

The HVAC system components were observed to be in fair to good condition and are not in need of repair.

4.21.3 Proposed HVAC System Replacement

The MZ AHUs serving Building 410 were considered for replacement with VAV AHUs with VSDs. The following equipment and materials will be included in the proposed HVAC system replacement:

- VAV AHUs with VSDs will replace the MZ AHUs.

- Existing ductwork will remain; VAV terminal units (pressure independent) will be installed on the zone supply air ducts.

- Thermostats will be installed in each zone; the thermostats will reset the VAV terminal unit controllers that vary the supply air to the zone.

Method of Analysis

The approach used for calculating energy savings included using a computer program to simulate a typical building. The EZDOE computer model for Building 409 (ENL Barracks) was used to evaluate energy savings for the proposed HVAC system replacement. Building 410 is similar to Buildings 409 and 402, all have similar HVAC systems. The areas served by the AHUs in Building 402 are identical to the areas served by AHUs in Building 410. The energy savings calculated for the proposed HVAC system replacement in Building 227 were prorated on a square foot basis to derive the energy savings for Building 410.

Energy Savings and Economic Analysis

The energy savings and economic analysis for the proposed HVAC system replacement are included in Appendix D. The results of the analysis are presented in the following table.

Item	HVAC System Replacement Energy Savings and Economics
Annual Electric Energy Savings (MBtu)	997
Annual Electric Demand Savings ($)	1,309
Annual Natural Gas Savings (MBtu)	(730)
Total Annual Energy Cost Savings	$10,362
Investment Cost	$77,512
Annual Maintenance Cost Savings	$0
Non-recurring Cost Savings	$51,813
Savings-to-Investment Ratio (SIR)	2.59
Simple Payback (yrs)	5.98

4.21.4 Recommendations

The proposed HVAC system replacement is recommended.

4.22 BUILDING 540 (ENLISTED BARRACKS W/AS)

4.22.1 HVAC System Existing Conditions

Building 540 is a 14,530 sq ft, two-story building. The building was built in 1965 and is constructed of a combination of face brick, wood siding, concrete block. The entire building is served by FCs that provide heating and cooling.

The following table describes the HVAC equipment serving Building 540.

HVAC System No.	HVAC System Type	Description of HVAC System	Existing Condition
FC-1 through FC-37	Two-pipe fan coil	Dual-temperature FCs provide heating and cooling to each room of the barracks. A total of 37 FCs serve the building.	Fair condition
BLR-1	Modular HW Boiler	Six modular HW boilers serve the FCs	Good condition
CH-1	Reciprocating w/ Air Cooled Cond.	70 Ton chiller serves the MZ AHUs and SZ AHU	Good condition (new)
DTWP-1 and DTWP-2	Dual Temperature Water pump	2 hp pumps serve CH-1, BLR-1, and FCs; one pump is a standby	Good condition

4.22.2 HVAC System Components for Repair

The HVAC system components were observed to be in fair to good condition and are not in need of repair.

4.22.3 Proposed HVAC System Replacement

The HVAC equipment serving Building 540 were not considered for HVAC system replacement.

4.22.4 Recommendations

The HVAC systems are not recommended for repair or replacement.

4.23 BUILDING 7404 (ENLISTED BARRACKS W/O DINING)

4.23.1 HVAC System Existing Conditions

Building 7404 is a 50,970 sq ft, three-story building with a partial basement. The building was built in 1958 and is constructed of face brick and concrete block. The barracks are located on the first, second, and third floors of the building.

Two large MZ AHUs provide cooling to the barracks, and a perimeter radiation system provides heating. The basement area is used as a storage and is heated by the perimeter radiation system (no cooling). The mechanical equipment room is also located in the basement.

The following table describes the HVAC equipment serving Building 7404.

HVAC System No.	HVAC System Type	Description of HVAC System	Existing Condition
RAD-1	Perimeter radiation	Perimeter radiation provides heating in all areas of the building; RAD-1 is divided into two piping circuits, the west piping circuit and the east piping circuit	Fair condition
AHU-1	MZ	MZ AHU with cooling coil serves the north half of the barracks on the 1st, 2nd, and 3rd floors of the building; (29,135 cfm at 7-1/2 hp)	Fair condition
AHU-2	MZ	MZ AHU with cooling coil serves the south half of the barracks on the 1st, 2nd, and 3rd floors of the building; (28,225 cfm at 7-1/2 hp)	Fair condition
	Chilled Water to the MZ AHUs	Chilled water is provided by a Central Chiller Plant	
BLR-1	HW Boiler	HW boiler serves FCs, AHUs, and RAD-1	Fair condition
HWP-1	HW pump	2 hp pump serves BLR-1 and RAD-1; HWP-1 serves the west piping circuit of RAD-1	Fair condition
HWP-2	HW pump	2 hp pump serves BLR-1 and RAD-1; HWP-2 serves the east piping circuit of RAD-1	Fair condition

4.23.2 HVAC System Components for Repair

The HVAC system components for RAD-1, AHU-1, AHU-2, BLR-1, HWP-1, and HWP-2 were observed to be in fair condition and are not in need of repair.

4.23.3 Proposed HVAC System Replacement

The two MZ AHUs serving Building 7404 were considered for conversion to VAV AHUs. The existing MZ AHUs will be modified as follows:

- VSD controllers will be installed on the MZ AHUs to control the supply fan speed.

- Both MZ AHUs have zone dampers for the cold deck only. The hot deck has a perforated plates in place of zone dampers. The pneumatic actuators on the cold deck zone dampers will be retrofitted with electric actuators and VAV terminal unit controllers. The perforated plates on the hot deck will be removed, and the area will be blanked off with sheet metal safing. The retrofitted dampers will vary the airflow rate to each zone.

- Thermostats will be installed in each zone; the thermostats will reset the VAV terminal unit controllers that vary the supply air to the zones.

Method of Analysis

The approach used for calculating energy savings included using a computer program to simulate a typical building. The EZDOE computer model for Building 7810 was used to evaluate energy savings for the proposed HVAC system replacement. Building 7810 is similar to Building 7404 except for the HVAC system. Building 7810 has fan coil units for heating and cooling; Building 7404 has MZ AHUs for cooling and HW perimeter radiation for heating.

The analysis proceeded as follows:

- The computer model for Building 7810 was modified to incorporate the MZ AHUs and HW perimeter radiation. This model was used for the baseline computer model.

- The baseline computer model was modified to include the HVAC replacement system - the MZ AHUs converted to VAV AHUs with VSDs. The modified baseline is the ECO model.

- The ECO model energy use was subtracted from the baseline energy use to find the energy savings for natural gas and electricity.

- A construction cost was developed for the proposed HVAC system replacement.

- The energy savings and the construction cost were entered into a LCCA worksheet. The economic life for the LCCA worksheet is 20 years.

Energy Savings and Economic Analysis

The energy savings and economic analysis for the proposed HVAC system replacement are included in Appendix D. The results of the analysis are presented in the following table.

Item	HVAC System Replacement Energy Savings and Economics
Annual Electric Energy Savings (MBtu)	364
Annual Electric Demand Savings ($)	378
Annual Natural Gas Savings (MBtu)	0
Total Annual Energy Cost Savings	$4,780
Investment Cost	$26,055
Annual Maintenance Cost Savings	$0
Non-recurring Cost Savings	$0
Savings-to-Investment Ratio (SIR)	2.90
Simple Payback (yrs)	5.45

4.23.4 Recommendations

The proposed HVAC system replacement is recommended.

4.24 BUILDING 7612 (ENLISTED BARRACKS W/O DINING)

4.24.1 HVAC System Existing Conditions

Building 7612 is a 41,890 sq ft, three-story building. The building was built in 1958 and is constructed of face brick and concrete block. The barracks are located on the first, second, and third floors of the building. The mechanical equipment room is located in the basement.

Approximately 92 FCs provide heating and cooling to the rooms in the barracks. Two SZ AHUs provide heating and cooling to the hallways throughout the building. Perimeter radiation units provide heating in the vestibules and latrines only.

The following table describes the HVAC equipment serving Building 7612.

HVAC System No.	HVAC System Type	Description of HVAC System	Existing Condition
FC-1 through FC-92	Two-pipe fan coil	Dual-temperature FCs provide heating and cooling to each dormitory room of the barracks. A total of 92 FCs serve the building; (approx. 500 cfm at 1/12 hp each)	Fair condition
AHU-1	SZ	SZ AHU with dual temperature coil serves the north half of the barracks hallways on the 1st, 2nd, and 3rd floors (3,500 cfm at 1 hp)	Fair condition
AHU-2	SZ	SZ AHU with dual temperature coil serves the south half of the barracks hallways on the 1st, 2nd, and 3rd floors (3,500 cfm at 1 hp)	Fair condition
RAD-1	Perimeter radiation	Perimeter radiation units provide heating in the latrines and vestibules of the building	Fair condition
CH-1	Reciprocating w/ Air Cooled Cond.	70 ton chiller serves FCs and SZ AHUs	Good condition
CWP-1	CW pump	1-1/2 hp pump serves CH-1	Fair condition
BLR-1	HW Boiler	HW boiler serves FCs, AHUs, and RAD-1	Fair condition
DTWP-1	Dual Temperature Water pump	2 hp pump serves dual temperature water system	Fair condition
DTWP-2	Dual Temperature Water pump	1-1/2 hp pump serves dual temperature water system	Fair condition
DTWP-3	Dual Temperature Water pump	1-1/2 hp pump serves dual temperature water system	Poor condition - pump seals leaking
DTWP-4	Dual Temperature Water pump	3 hp pump serves dual temperature water system	Fair condition
HWP-1	HW pump	1/2 hp pump serves perimeter radiation units	Fair condition - some rust on pump and piping to pump

4.24.2 HVAC System Components for Repair

The HVAC system components were observed to be generally in fair condition. The HVAC system component in need of immediate repair is listed in the following table, with the repair cost.

HVAC System No.	HVAC System Type	Description of HVAC System Component for Repair	Repair Cost ($)
DTWP-3	Dual Temperature Water pump	1-1/2 hp pump is leaking and requires replacement of pump seals	208

4.24.3 Proposed HVAC System Replacement

The FCs and AHUs serving Building 7612 were considered for HVAC system replacement. The FCs and AHUs will be replaced with six VAV AHU systems each serving half of the three floors in the building. Two EM Squad rooms per floor will be converted to mechanical equipment rooms to install the VAV AHUs. The following equipment and materials are included in the proposed HVAC system replacement:

- VAV AHUs with VSDs; a dual temperature coil will be included in each VAV AHU for heating and cooling.
- Main supply air ductwork will be installed in the hallways above the acoustic tile ceiling.
- Branch supply air ductwork will be installed from the main ductwork to individual rooms.
- VAV terminal units with electric actuators will be installed on the branch ductwork to each room; thermostats will be installed in each room.
- Ceiling space will be used as a return air plenum for each VAV AHU.
- Dual temperature water supply and return piping will be installed from each VAV AHU to the basement MER.
- New circulating pumps will be installed in the basement MER to serve the VAV AHUs.

Method of Analysis

The approach used for calculating energy savings included using a computer program to simulate a typical building. The EZDOE computer model for Building 7612 was used to evaluate energy savings for the proposed HVAC system replacement.

The analysis proceeded as follows:

- The computer model for Building 7612 was used as the baseline computer model.
- The baseline computer model was modified to include the HVAC replacement system - the VAV AHUs. The modified baseline is the ECO model. The ECO model included additional modifications as follows:
  - The total OA from ventilation and infiltration is presently 11,400 cfm (SZ AHUs provide 7,000 cfm of OA for ventilation in hallways and 4,400 cfm of OA is from infiltration). The proposed system will reduce OA to a total of 4,300 cfm (3,060 cfm OA ventilation through the VAV AHUs and 1,240 cfm OA from infiltration). The VAV AHUs, serving all areas of the building, will reduce the infiltration by pressurizing the building. There are approximately 150 people in the barracks.
- The ECO model energy use was subtracted from the baseline energy use to find the energy savings for natural gas and electricity.
- A construction cost was developed for the proposed HVAC system replacement.
- The energy savings and the construction cost were entered into a LCCA worksheet. Additional information entered into the LCCA worksheet included the following:
  - Economic life is 20 years.
  - Annual maintenance costs were calculated using estimated labor hours and materials.
  - Avoided cost of existing system replacement was included as a non-recurring fifth year cost.

Energy Savings and Economic Analysis

The energy savings and economic analysis for the proposed HVAC system replacement are included in Appendix D. The results of the analysis are presented in the following table.

Item	HVAC System Replacement Energy Savings and Economics
Annual Electric Energy Savings (MBtu)	95
Annual Electric Demand Savings ($)	(1,233)
Annual Natural Gas Savings (MBtu)	2,176
Total Annual Energy Cost Savings	$8,881
Investment Cost	$434,560
Annual Maintenance Cost Savings	$5,147
Non-recurring Cost Savings	$179,196
Savings-to-Investment Ratio (SIR)	0.91
Simple Payback (yrs)	18.90

4.24.4 Recommendations

The HVAC system component for repair is recommended.

4.25 BUILDING 7614 (ENLISTED BARRACKS W/O DINING)

4.25.1 HVAC System Existing Conditions

Building 7614 is a 41,890 sq ft, three-story building. The building was built in 1958 and is constructed of face brick and concrete block. The barracks are located on the first, second, and third floors of the building. The mechanical equipment room is located in the basement. Approximately 92 FCs provide heating and cooling to the rooms in the barracks. Two SZ AHUs provide heating and cooling to the hallways throughout the building. Perimeter radiation units provide heating in the vestibules and latrines only.

The following table describes the HVAC equipment serving Building 7614.

HVAC System No.	HVAC System Type	Description of HVAC System	Existing Condition
FC-1 through FC-92	Two-pipe fan coil	Dual-temperature FCs provide heating and cooling to each dormitory room of the barracks. A total of 92 FCs serve the building; (approx. 500 cfm at 1/12 hp each)	Fair condition
AHU-1	SZ	SZ AHU with dual temperature coil serves the north half of the barracks hallways on the 1st, 2nd, and 3rd floors (3,500 cfm at 1 hp)	Fair condition
AHU-2	SZ	SZ AHU with dual temperature coil serves the south half of the barracks hallways on the 1st, 2nd, and 3rd floors (3,500 cfm at 1 hp)	Fair condition
RAD-1	Perimeter radiation	Perimeter radiation units provide heating in the latrines and vestibules of the building	Fair condition
CH-1	Reciprocating w/ Air Cooled Cond.	70 ton chiller serves FCs and SZ AHUs	Good condition
CWP-1	CW pump	1-1/2 hp pump serves CH-1	Poor condition - leaky pump seals
BLR-1	HW Boiler	HW boiler serves FCs, AHUs, and RAD-1	Fair condition
DTWP-1	Dual Temperature Water pump	2 hp pump serves dual temperature water system	Fair condition
DTWP-2	Dual Temperature Water pump	1-1/2 hp pump serves dual temperature water system	Fair condition
DTWP-3	Dual Temperature Water pump	1-1/2 hp pump serves dual temperature water system	Poor condition - pump seals leaking
DTWP-4	Dual Temperature Water pump	3 hp pump serves dual temperature water system	Poor condition - pump seals leaking
HWP-1	HW pump	1/2 hp pump serves perimeter radiation units	Fair condition - some rust on pump and piping to pump

4.25.2 HVAC System Components for Repair

The HVAC system components were observed to be generally in fair condition. The HVAC system components in need of immediate repair are listed in the following table, with the repair costs.

HVAC System No.	HVAC System Type	Description of HVAC System Component for Repair	Repair Cost ($)
CWP-1	CW pump	1-1/2 hp pump is leaking and requires replacement of pump seals	208
DTWP-3	Dual Temperature Water pump	1-1/2 hp pump is leaking and requires replacement of pump seals	208
DTWP-4	Dual Temperature Water pump	3 hp pump is leaking and requires replacement of pump seals	209
		Total Repair Cost	625

4.25.3 Proposed HVAC System Replacement

The FCs serving Building 7614 were considered for replacement. The FCs and AHUs will be replaced with six VAV AHU systems each serving half of the three floors in the building. Two EM Squad rooms per floor will be converted to mechanical equipment rooms to install the VAV AHUs. The following equipment and materials are included in the proposed HVAC system replacement:

- VAV AHUs with VSDs; a dual temperature coil will be included in each VAV AHU for heating and cooling.
- Main supply air ductwork will be installed in the hallways above the acoustic tile ceiling.
- Branch supply air ductwork will be installed from the main ductwork to individual rooms.
- VAV terminal units with electric actuators will be installed on the branch ductwork to each room; thermostats will be installed in each room.
- Ceiling space will be used as a return air plenum for each VAV AHU.
- Dual temperature water supply and return piping will be installed from each VAV AHU to the basement MER.
- New circulating pumps will be installed in the basement MER to serve the VAV AHUs.

Method of Analysis

The approach used for calculating energy savings included using a computer program to simulate a typical building. The EZDOE computer model for Building 7612 (ENL Barracks) was used to evaluate energy savings for the proposed HVAC system replacement. Building 7614 is identical to Building 7612. The analysis, energy savings, and system replacement cost for Building 7614 are taken from Building 7612.

Energy Savings and Economic Analysis

The energy savings and economic analysis for the proposed HVAC system replacement are included in Appendix D. The results of the analysis are presented in the following table.

Item	HVAC System Replacement Energy Savings and Economics
Annual Electric Energy Savings (MBtu)	95
Annual Electric Demand Savings ($)	(1,233)
Annual Natural Gas Savings (MBtu)	2,176
Total Annual Energy Cost Savings	$8,881
Investment Cost	$389,740
Annual Maintenance Cost Savings	$5,147
Non-recurring Cost Savings	$179,196
Savings-to-Investment Ratio (SIR)	0.91
Simple Payback (yrs)	18.90

4.25.4 Recommendations

The HVAC system components for repair are recommended.

4.26 BUILDING 7616 (ENLISTED BARRACKS W/O DINING)

4.26.1 HVAC System Existing Conditions

Building 7616 is a 41,890 sq ft, three-story building. The building was built in 1958 and is constructed of face brick and concrete block. The barracks are located on the first, second, and third floors of the building. The mechanical equipment room is located in the basement. Approximately 92 FCs provide heating and cooling to the rooms in the barracks. Two SZ AHUs provide heating and cooling to the hallways throughout the building. Perimeter radiation units provide heating in the vestibules and latrines only.

The following table describes the HVAC equipment serving building 7616.

HVAC System No.	HVAC System Type	Description of HVAC System	Existing Condition
FC-1 through FC-92	Two-pipe fan coil	Dual-temperature FCs provide heating and cooling to each dormitory room of the barracks. A total of 92 FCs serve the building; (approx. 500 cfm at 1/12 hp each)	Fair condition
AHU-1	SZ	SZ AHU with dual temperature coil serves the east half of the barracks hallways on the 1st, 2nd, and 3rd floors (3,500 cfm at 1 hp)	Fair condition
AHU-2	SZ	SZ AHU with dual temperature coil serves the west half of the barracks hallways on the 1st, 2nd, and 3rd floors (3,500 cfm at 1 hp)	Fair condition
RAD-1	Perimeter radiation	Perimeter radiation units provide heating in the latrines and vestibules of the building	Fair condition
CH-1	Reciprocating w/ Air Cooled Cond.	70 ton chiller serves FCs and SZ AHUs	Good condition
CWP-1	CW pump	1-1/2 hp pump serves CH-1	Fair condition
BLR-1	HW Boiler	HW boiler serves FCs, AHUs, and RAD-1	Fair condition
DTWP-1	Dual Temperature Water pump	2 hp pump serves dual temperature water system	Fair condition
DTWP-2	Dual Temperature Water pump	1-1/2 hp pump serves dual temperature water system	Fair condition
DTWP-3	Dual Temperature Water pump	1-1/2 hp pump serves dual temperature water system	Fair condition
DTWP-4	Dual Temperature Water pump	3 hp pump serves dual temperature water system	Fair condition
HWP-1	HW pump	1/2 hp pump serves perimeter radiation units	Fair condition

4.26.2 HVAC System Components for Repair

The HVAC system components were observed to be in fair condition and are not in need of repair.

4.26.3 Proposed HVAC System Replacement

The FCs serving building 7616 were considered for replacement. The FCs and AHUs will be replaced with six VAV AHU systems each serving half of the three floors in the building. Two EM Squad rooms per floor will be converted to mechanical equipment rooms to install the VAV AHUs. The following equipment and materials are included in the proposed HVAC system replacement:

- VAV AHUs with VSDs; a dual temperature coil will be included in each VAV AHU for heating and cooling.
- Main supply air ductwork will be installed in the hallways above the acoustic tile ceiling.
- Branch supply air ductwork will be installed from the main ductwork to individual rooms.
- VAV terminal units with electric actuators will be installed on the branch ductwork to each room; thermostats will be installed in each room.
- Ceiling space will be used as a return air plenum for each VAV AHU.
- Dual temperature water supply and return piping will be installed from each VAV AHU to the basement MER.
- New circulating pumps will be installed in the basement MER to serve the VAV AHUs.

Method of Analysis

The approach used for calculating energy savings included using a computer program to simulate a typical building. The EZDOE computer model for Building 7612 (ENL Barracks) was used to evaluate energy savings for the proposed HVAC system replacement. Building 7616 is identical to Building 7612. The analysis, energy savings, and system replacement cost for Building 7616 are taken from Building 7612.

Energy Savings and Economic Analysis

The energy savings and economic analysis for the proposed HVAC system replacement are included in Appendix D. The results of the analysis are presented in the following table.

Item	HVAC System Replacement Energy Savings and Economics
Annual Electric Energy Savings (MBtu)	95
Annual Electric Demand Savings ($)	(1,233)
Annual Natural Gas Savings (MBtu)	2,176
Total Annual Energy Cost Savings	$8,881
Investment Cost	$389,740
Annual Maintenance Cost Savings	$5,147
Non-recurring Cost Savings	$179,196
Savings-to-Investment Ratio (SIR)	0.91
Simple Payback (yrs)	18.90

4.26.4 Recommendations

The proposed HVAC system replacement is not recommended.

4.27 BUILDING 7810 (ENLISTED BARRACKS W/O DINING)

4.27.1 HVAC System Existing Conditions

Building 7810 is a 41,840 sq ft, three-story building. The building was built in 1958 and is constructed of face brick and concrete block. The barracks are located on the first, second, and third floors of the building. The mechanical equipment room is located in the basement. Approximately 92 FCs provide heating and cooling to the rooms in the barracks. Two SZ AHUs provide heating and cooling to the hallways throughout the building. Perimeter radiation units provide heating in the vestibules and latrines only.

The following table describes the HVAC equipment serving Building 7810.

HVAC System No.	HVAC System Type	Description of HVAC System	Existing Condition
FC-1 through FC-92	Two-pipe fan coil	Dual-temperature FCs provide heating and cooling to each dormitory room of the barracks. A total of 92 FCs serve the building; (approx. 500 cfm at 1/12 hp each)	Fair condition
AHU-1	SZ	SZ AHU with dual temperature coil serves the east half of the barracks hallways on the 1st, 2nd, and 3rd floors (3,500 cfm at 1 hp)	Fair condition
AHU-2	SZ	SZ AHU with dual temperature coil serves the west half of the barracks hallways on the 1st, 2nd, and 3rd floors (3,500 cfm at 1 hp)	Fair condition
RAD-1	Perimeter radiation	Perimeter radiation units provide heating in the latrines and vestibules of the building	Fair condition
CH-1	Reciprocating w/ Air Cooled Cond.	70 ton chiller serves FCs and SZ AHUs	Good condition
CWP-1	CW pump	1-1/2 hp pump serves CH-1	Fair condition
BLR-1	HW Boiler	HW boiler serves FCs, AHUs, and RAD-1	Fair condition
DTWP-1	Dual Temperature Water pump	2 hp pump serves dual temperature water system	Fair condition
DTWP-2	Dual Temperature Water pump	1-1/2 hp pump serves dual temperature water system	Fair condition
DTWP-3	Dual Temperature Water pump	2 hp pump serves dual temperature water system	Poor condition - pump seals leaking
DTWP-4	Dual Temperature Water pump	3 hp pump serves dual temperature water system	Poor condition - pump seals leaking
HWP-1	HW pump	1/2 hp pump serves perimeter radiation units	Fair condition

4.27.2 HVAC System Components for Repair

The HVAC system components were observed to be generally in fair condition. The HVAC system components in need of immediate repair are listed in the following table, with the estimated costs for repair.

HVAC System No.	HVAC System Type	Description of HVAC System Component for Repair	Repair Cost ($)
DTWP-3	Dual Temperature Water pump	2 hp pump is leaking and requires replacement of pump seals	209
DTWP-4	Dual Temperature Water pump	1-1/2 hp pump is leaking and requires replacement of pump seals	208
		Total Repair Cost	417

4.27.3 Proposed HVAC System Replacement

The FCs serving Building 7810 were considered for replacement. The FCs and AHUs will be replaced with six VAV AHU systems each serving half of the three floors in the building. Two EM Squad rooms per floor will be converted to mechanical equipment rooms to install the VAV AHUs. The following equipment and materials are included in the proposed HVAC system replacement:

- VAV AHUs with VSDs; a dual temperature coil will be included in each VAV AHU for heating and cooling.
- Main supply air ductwork will be installed in the hallways above the acoustic tile ceiling.
- Branch supply air ductwork will be installed from the main ductwork to individual rooms.
- VAV terminal units with electric actuators will be installed on the branch ductwork to each room; thermostats will be installed in each room.
- Ceiling space will be used as a return air plenum for each VAV AHU.
- Dual temperature water supply and return piping will be installed from each VAV AHU to the basement MER.
- New circulating pumps will be installed in the basement MER to serve the VAV AHUs.

Method of Analysis

The approach used for calculating energy savings included using a computer program to simulate a typical building. The EZDOE computer model for Building 7612 (ENL Barracks) was used to evaluate energy savings for the proposed HVAC system replacement. Building 7810 is identical to Building 7612. The analysis, energy savings, and system replacement cost for Building 7810 are taken from Building 7612.

Energy Savings and Economic Analysis

The energy savings and economic analysis for the proposed HVAC system replacement are included in Appendix D. The results of the analysis are presented in the following table.

Item	HVAC System Replacement Energy Savings and Economics
Annual Electric Energy Savings (MBtu)	95
Annual Electric Demand Savings ($)	(1,233)
Annual Natural Gas Savings (MBtu)	2,176
Total Annual Energy Cost Savings	$8,881
Investment Cost	$389,740
Annual Maintenance Cost Savings	$5,147
Non-recurring Cost Savings	$179,196
Savings-to-Investment Ratio (SIR)	0.91
Simple Payback (yrs)	18.90

4.27.4 Recommendations

The HVAC system components for repair are recommended.

4.28 BUILDING 7814 (ENLISTED BARRACKS W/O DINING)

4.28.1 HVAC System Existing Conditions

Building 7814 is a 41,840 sq ft, three-story building. The building was built in 1958 and is constructed of face brick and concrete block. The barracks are located on the first, second, and third floors of the building. The mechanical equipment room is located in the basement. Approximately 92 FCs provide heating and cooling to the rooms in the barracks. Two SZ AHUs provide heating and cooling to the hallways throughout the building. Perimeter radiation units provide heating in the vestibules and latrines only.

The following table describes the HVAC equipment serving Building 7814.

HVAC System No.	HVAC System Type	Description of HVAC System	Existing Condition
FC-1 through FC-92	Two-pipe fan coil	Dual-temperature FCs provide heating and cooling to each dormitory room of the barracks. A total of 92 FCs serve the building; (approx. 500 cfm at 1/12 hp each)	Fair condition
AHU-1	SZ	SZ AHU with dual temperature coil serves the east half of the barracks hallways on the 1st, 2nd, and 3rd floors (3,500 cfm at 1 hp)	Fair condition
AHU-2	SZ	SZ AHU with dual temperature coil serves the west half of the barracks hallways on the 1st, 2nd, and 3rd floors (3,500 cfm at 1 hp)	Fair condition
RAD-1	Perimeter radiation	Perimeter radiation units provide heating in the latrines and vestibules of the building	Fair condition
CH-1	Reciprocating w/ Air Cooled Cond.	70 ton chiller serves FCs and SZ AHUs	Good condition
CWP-1	CW pump	1-1/2 hp pump serves CH-1	Fair condition
BLR-1	HW Boiler	HW boiler serves FCs, AHUs, and RAD-1	Fair condition
DTWP-1	Dual Temperature Water pump	Pump is missing; estimate a 2 hp pump for replacement	Poor condition
DTWP-2	Dual Temperature Water pump	1-1/2 hp pump serves dual temperature water system	Fair condition
DTWP-3	Dual Temperature Water pump	2 hp pump serves dual temperature water system	Fair condition - exterior of pump very rusted
DTWP-4	Dual Temperature Water pump	3 hp pump serves dual temperature water system	Fair condition
HWP-1	HW pump	1/2 hp pump serves perimeter radiation units	Poor condition - pump bearings are noisy

4.28.2 HVAC System Components for Repair

The HVAC system components were observed to be generally in fair condition. The HVAC system components in need of immediate repair are listed in the following table, with the repair costs.

HVAC System No.	HVAC System Type	Description of HVAC System Component for Repair	Repair Cost ($)
DTWP-1	Dual Temperature Water pump	2 hp pump is missing and requires installation	1,011
HWP-1	HW pump	1/2 hp pump is noisy and requires replacement of pump bearings and seals	208
		Total Repair Cost	1,219

4.28.3 Proposed HVAC System Replacement

The FCs serving building 7814 were considered for replacement. The FCs and AHUs will be replaced with six VAV AHU systems each serving half of the three floors in the building. Two EM Squad rooms per floor will be converted to mechanical equipment rooms to install the VAV AHUs. The following equipment and materials are included in the proposed HVAC system replacement:

- VAV AHUs with VSDs; a dual temperature coil will be included in each VAV AHU for heating and cooling.
- Main supply air ductwork will be installed in the hallways above the acoustic tile ceiling.
- Branch supply air ductwork will be installed from the main ductwork to individual rooms.
- VAV terminal units with electric actuators will be installed on the branch ductwork to each room; thermostats will be installed in each room.
- Ceiling space will be used as a return air plenum for each VAV AHU.
- Dual temperature water supply and return piping will be installed from each VAV AHU to the basement MER.
- New circulating pumps will be installed in the basement MER to serve the VAV AHUs.

Method of Analysis

The approach used for calculating energy savings included using a computer program to simulate a typical building. The EZDOE computer model for Building 7612 (ENL Barracks) was used to evaluate energy savings for the proposed HVAC system replacement. Building 7814 is identical to Building 7612. The analysis, energy savings, and system replacement cost for Building 7814 are taken from Building 7612.

Energy Savings and Economic Analysis

The energy savings and economic analysis for the proposed HVAC system replacement are included in Appendix D. The results of the analysis are presented in the following table.

Item	HVAC System replacement Energy Savings and Economics
Annual Electric Energy Savings (MBtu)	95
Annual Electric Demand Savings ($)	(1,233)
Annual Natural Gas Savings (MBtu)	2,176
Total Annual Energy Cost Savings	$8,881
Investment Cost	$389,740
Annual Maintenance Cost Savings	$5,147
Non-recurring Cost Savings	$179,196
Savings-to-Investment Ratio (SIR)	0.91
Simple Payback (yrs)	18.90

4.28.4 Recommendations

The HVAC system components for repair are recommended.

4.29 BUILDING 7050 (ENLISTED BARRACKS WITH DINING)

4.29.1 HVAC System Existing Conditions

Building 7050 is a 39,680 sq ft, three-story building. The building was built during the mid-1950s and is constructed of concrete block. The barracks are located on the first, second, and third floors of the building. The dining hall and kitchen is located on the first floor level at the south end of the building. The mechanical equipment room is located in the basement. In 1975, a modernization project upgraded the barracks with new HVAC equipment including FCs, CW piping, and ductwork modifications for the SZ and H&V Units. A recent modernization project (within the last three years) has provided new HW boilers, HW pumps, and CW pumps.

Approximately 93 FCs provide cooling to the rooms in the barracks. Perimeter radiation provides heating to the rooms in the barracks. A SZ AHU provides heating and cooling to the dining hall. A H&V Unit provides heating to the kitchen area and make-up air for the kitchen exhaust hood.

The following table describes the HVAC equipment serving Building 7050.

HVAC System No.	HVAC System Type	Description of HVAC System	Existing Condition
FC-1 through FC-93	Two-pipe fan coil	FCs provide cooling only to the rooms in the barracks. A total of 93 FCs serve the building; (approx. 500 cfm at 1/12 hp each)	Fair condition
AHU-1	SZ	SZ AHU provides heating and cooling to the dining hall	Fair condition
H&V-1	H&V Unit	H&V Unit provides heating and make-up air to the kitchen area	Fair condition
RAD-1	Perimeter radiation	Perimeter radiation units provide heating throughout the building	Fair condition
	Chilled Water to the FCs and SZ AHU	Chilled water is provided by a Central Chiller Plant	
BLR-1 and BLR-2	HW Boiler	HW boilers serve AHU-1, FCs, and RAD-1 (1,749,000 Btuh output each)	Good condition
BLR-3	Steam Boiler	Steam boiler serves H&V-1 and kitchen equipment (1,204,800 Btuh output)	Good condition
BP-1	Boiler pump	1-1/2 hp pump serves BLR-1	Good condition
BP-2	Boiler pump	1-1/2 hp pump serves BLR-2	Good condition
CWP-1	Chilled Water pump	2 hp pump serves chilled water system FCs	Good condition
CWP-2	Chilled Water pump	2 hp pump serves chilled water system FCs	Good condition
HWP-1	HW pump	3/4 hp pump serves RAD-1 (perimeter radiation units)	Good condition

4.29.2 HVAC System Components for Repair

The HVAC system components were observed to be in fair to good condition and are not in need of repair.

4.29.3 Proposed HVAC System Replacement

The HVAC equipment serving Building 7050 were not considered for replacement. The replacement of the cooling-only FC system with a cooling-only VAV system would not be practical economically. Energy savings would only be accrued for the cooling season (5 months out of the year). The construction cost for VAV AHUs and ductwork would be very high compared to the amount of energy dollar savings.

4.29.4 Recommendations

The HVAC systems are not recommended for repair or replacement.

4.30 BUILDING 7053 (ENLISTED BARRACKS W/O DINING)

4.30.1 HVAC System Existing Conditions

Building 7053 is a 39,680 sq ft, three-story building. The building was built during the mid-1950s and is constructed of concrete block. The barracks are located on the first, second, and third floors of the building. The former dining hall and kitchen, located on the first floor level at the south end of the building, is used as a storage area. The mechanical equipment room is located in the basement. In 1975, a modernization project upgraded the barracks with new HVAC equipment including FCs and CW piping. A recent modernization project (within the last three years) has provided new HW boilers, HW pumps, and CW pumps.

Approximately 93 FCs provide cooling to the rooms in the barracks, and perimeter radiation units provide heating throughout the barracks. The following table describes the HVAC equipment serving Building 7053.

HVAC System No.	HVAC System Type	Description of HVAC System	Existing Condition
FC-1 through FC-93	Two-pipe fan coil	FCs provide cooling to rooms in the barracks. A total of 93 FCs serve the building; (approx. 500 cfm at 1/12 hp each)	Fair condition
RAD-1	Perimeter radiation	Perimeter radiation units provide heating throughout the entire building	Fair condition
	Chilled Water to the FCs and SZ AHU	Chilled water is provided by a Central Chiller Plant	
BLR-1 and BLR-2	HW Boiler	HW boilers serve RAD-1 (1,749,000 Btuh output each)	Good condition
BP-1	Boiler pump	1-1/2 hp pump serves BLR-1	Good condition
BP-2	Boiler pump	1-1/2 hp pump serves BLR-2	Good condition
CWP-1	Chilled Water pump	2 hp pump serves chilled water system FCs	Good condition
CWP-2	Chilled Water pump	2 hp pump serves chilled water system FCs	Good condition
HWP-1	HW pump	3/4 hp pump serves RAD-1 (perimeter radiation units)	Good condition

4.30.2 HVAC System Components for Repair

The HVAC system components were observed to be in fair to good condition and are not in need of repair.

4.30.3 Proposed HVAC System Replacement

The HVAC equipment serving Building 7053 were not considered for replacement. The replacement of the cooling-only FC system with a cooling-only VAV system would not be practical economically. Energy savings would only be accrued for the cooling season (5 months out of the year). The construction cost for VAV AHUs and ductwork would be very high compared to the amount of energy dollar savings.

4.30.4 Recommendations

The HVAC systems are not recommended for repair or replacement.

4.31 BUILDINGS 8002, 8012, 8038, 8042, AND 8052 (ENLISTED BARRACKS W/O DINING)

4.31.1 HVAC System Existing Conditions

These Enlisted Barracks are 22,700 sq ft, three-story buildings. The buildings were built in 1975 and constructed of face brick and concrete block. The barracks rooms are located on the first, second, and third floors of the building. The mechanical equipment room is located on the first floor level. Approximately 72 FCs provide heating and cooling to the rooms and hallways in each barracks.

The following table describes the HVAC equipment serving these buildings.

HVAC System No.	HVAC System Type	Description of HVAC System	Existing Condition
FC-1 through FC-72	Two-pipe fan coil	Dual-temperature FCs provide heating and cooling to each dormitory room, hallways, and dayrooms in the barracks. A total of 72 FCs serve the building.	Fair to poor condition - some control valves are leaky and most have been removed; some fan switches are broken and inoperable
	Chilled Water to the FCs	Chilled water is provided by a Central Chiller Plant	
CV-1	Steam/HW converter	CV-1 provides HW to the FCs; steam is provided by a Central Boiler Plant	Poor condition - exterior rust and corrosion from leaking pipes, insulation damaged and missing
DTWP-1	Dual Temperature Water pump	5 hp pump serves dual temperature water system FCs	Poor condition - exterior rust and corrosion, insulation damaged and missing

4.31.2 HVAC System Components for Repair

The HVAC system components were observed to be in poor condition. Control valves on the FCs in the hallways were observed to be leaky and corroded. A controls renovation project has removed the control valves from the FCs in the dormitory rooms and dayrooms. The control valves on the FCs in the hallways remained. The three speed fan switches on FCs in the dayrooms are broken or damaged. These HVAC system components in need of immediate repair are listed in the following table, with the repair costs.

HVAC System No.	HVAC System Type	Description of HVAC System Component for Repair	Repair Cost ($)
FC-1 through FC-72	Two-pipe fan coil	1/2" control valves leaking, corroded - replace 48 control valves	9,425
FC-1 through FC-72	Two-pipe fan coil	3 speed fan switches on FCs in dayrooms are broken or damaged - replace 48 fan switches	1,710
		Total Repair Cost	11,135

4.31.3 Proposed HVAC System Replacement

A proposed HVAC system replacement was considered, but would not be feasible given the architectural design of the building. This system replacement is described as follows:

- Four SZ AHUs per floor ducted to 16 dormitory rooms (4 rooms per SZ AHU).
- SZ AHUs installed in dayrooms converted to MERs.
- Dual temperature water piped from existing MER up through floors and through hallways to MERs.

The MERs, placed in the dayrooms, would take up most of the space and eliminate functional use of dayrooms. Establishing a dormitory room as a MER on each floor would reduce available space for quarters. A building addition could be constructed to provide space for MERs. These proposed MER locations would not be practical or feasible for this type of barracks. Individual room fan coils are the only practical way to condition these buildings.

4.31.4 Recommendations

The HVAC system components for repair are recommended.

4.32 BUILDINGS 8014, 8040, 8048, AND 8050 (ENLISTED BARRACKS W/O DINING)

4.32.1 HVAC System Existing Conditions

These Enlisted Barracks are 11,550 sq ft, three-story buildings. The buildings were built in 1975 and constructed of face brick and concrete block. The barracks rooms are located on the first, second, and third floors of the building. The mechanical equipment room is located on the first floor level. Approximately 36 FCs provide heating and cooling to the rooms and hallways in each barracks.

The following table describes the HVAC equipment serving these buildings.

HVAC System No.	HVAC System Type	Description of HVAC System	Existing Condition
FC-1 through FC-36	Two-pipe fan coil	Dual-temperature FCs provide heating and cooling to each dormitory room, hallways, and dayrooms in the barracks. A total of 36 FCs serve the building.	Fair to poor condition - some control valves are leaky and some have been removed; some fan switches are broken and inoperable
	Chilled Water to the FCs	Chilled water is provided by a Central Chiller Plant	
CV-1	Steam/HW converter	CV-1 provides HW to the FCs; steam is provided by a Central Boiler Plant	Poor condition - exterior rust and corrosion from leaking pipes, insulation damaged and missing
DTWP-1	Dual Temperature Water pump	1.5 hp pump serves dual temperature water system FCs	Poor condition - exterior rust and corrosion, insulation damaged and missing

4.32.2 HVAC System Components for Repair

The HVAC system components were observed to be in poor condition. Control valves on the FCs in the hallways were observed to be leaky and corroded. A controls renovation project has removed the control valves from the FCs in the dormitory rooms and dayrooms. The control valves on the FCs in the hallways remained. The three speed fan switches on FCs in the dayrooms are broken or damaged. These HVAC system components in need of immediate repair are listed in the following table, with the repair costs.

HVAC System No.	HVAC System Type	Description of HVAC System Component for Repair	Repair Cost ($)
FC-1 through FC-36	Two-pipe fan coil	1/2" control valves leaking, corroded - replace 24 control valves	3,772
FC-1 through FC-36	Two-pipe fan coil	3 speed fan switches on FCs in dayrooms are broken or damaged - replace 24 fan switches	684
		Total Repair Cost	4,456

4.32.3 Proposed HVAC System Replacement

A proposed HVAC system replacement was considered, but would not be feasible given the architectural design of the building. This system replacement is described as follows:

- Two SZ AHUs per floor ducted to 8 dormitory rooms (4 rooms per SZ AHU).
- SZ AHUs installed in dayrooms converted to MERs.
- Dual temperature water piped from existing MER up through floors and through hallways to MERs.

The MERs, placed in the dayrooms, would take up most of the space and eliminate functional use of dayrooms. Establishing a dormitory room as a MER on each floor would reduce available space for quarters. A building addition could be constructed to provide space for MERs. These proposed MER locations would not be practical or feasible for this type of barracks. Individual room fan coils are the only practical way to condition these buildings.

4.32.4 Recommendations

The HVAC system components for repair are recommended.

4.33 BUILDING 7806 (BATTALION HEADQUARTERS)

4.33.1 HVAC System Existing Conditions

Building 7806 is a 13,490 sq ft, one-story building. The building was built in 1958, originally as a Five Company Mess Hall, and is constructed of face brick and concrete block. It was renovated in 1968 into a Battalion Headquarters building. The building is heated and cooled by two SZ AHUs. The entire building is heated by perimeter radiation units.

The following table describes the HVAC equipment serving Building 7806.

HVAC System No.	HVAC System Type	Description of HVAC System	Existing Condition
AHU-1	SZ	SZ AHU provides heating and cooling to the south half of the building; 6,400 cfm at 3 hp	Poor condition
AHU-2	SZ	SZ AHU provides heating and cooling to the north half of the building; 6,600 cfm at 3 hp	Poor condition
RAD-1	HW baseboard radiation	Perimeter radiation provides heating throughout the building	Fair condition
CH-1	Reciprocating w/ Air Cooled Cond.	70 Ton chiller serves SZ AHUs	Fair condition
CWP-1	CW pump	5 hp pump serves CH-1 and SZ AHUs	Fair condition
BLR-1	STM Boiler	STM boiler serves SZ AHUs and RAD-1	Fair condition
CV-1	STM/HW Converter	CV-1 provides HW to RAD-1	Fair condition
HWP-1	HW pump	3/4 hp pump serves CV-1 and RAD-1	Fair condition

4.33.2 HVAC System Components for Repair

The HVAC system components for building 7806 were observed to be generally in fair condition and are not in need of repair.

4.33.3 Proposed HVAC System Replacement

The SZ AHUs were considered for replacement with VAV AHUs. The following equipment and materials are included in the proposed HVAC system replacement:

- VAV AHUs with VSDs will replace the SZ AHUs.

- VAV terminal units with reheat coils will be installed on the zone supply air ducts; the existing ductwork will remain.

- Thermostats will be installed in each zone; the thermostats will reset the VAV terminal unit controllers that vary the supply air to the zones.

Method of Analysis

The approach used for calculating energy savings included using a computer program to simulate a typical building. The EZDOE computer model for Building 7656 was used to evaluate energy savings for the proposed HVAC system replacement. Building 7656 is similar to Building 7806 except for the HVAC system. Building 7656 has MZ AHUs for heating and cooling; Building 7806 has SZ AHUs for heating and cooling.

The analysis proceeded as follows:

- The computer model for Building 7656 was modified to incorporate the SZ AHUs. This model was used for the baseline computer model.

- The baseline computer model was modified to include the HVAC replacement systems - the VAV AHUs with a VSDs. The VSD controls were set to vary the supply air volume down to 20%. The modified baseline is the ECO model.

- The ECO model energy use was subtracted from the baseline energy use to find the energy savings for natural gas and electricity.

- A construction cost was developed for the proposed HVAC system replacement.

- The energy savings and the construction cost were entered into a LCCA worksheet. Additional information entered into the LCCA worksheet included the following:

  - Economic life is 20 years.

  - Avoided cost of existing system replacement was included as a non-recurring fifth year cost.

Energy Savings and Economic Analysis

The energy savings and economic analysis for the proposed HVAC system replacement are included in Appendix D. The results of the analysis are presented in the following table.

Item	HVAC System Replacement Energy Savings and Economics
Annual Electric Energy Savings (MBtu)	263
Annual Electric Demand Savings ($)	735
Annual Natural Gas Savings (MBtu)	(95)
Total Annual Energy Cost Savings	$3,526
Investment Cost	$34,973
Annual Maintenance Cost Savings	$0
Non-recurring Cost Savings	$23,323
Savings-to-Investment Ratio (SIR)	2.13
Simple Payback (yrs)	7.45

4.33.4 Recommendations

The proposed HVAC system replacement is recommended.

4.34 BUILDING 8025 (BATTALION ADMINISTRATION AND CLASSROOMS)

4.34.1 HVAC System Existing Conditions

Building 8025 is a 12,000 sq ft, one-story building. The building was built in 1975 and is constructed of face brick and concrete block. Three MZ AHUs provide cooling to two large classrooms and administrative offices. The entire building is heated by HW perimeter radiation units.

The following table describes the HVAC equipment serving Building 8025.

HVAC System No.	HVAC System Type	Description of HVAC System	Existing Condition
AHU-1	MZ	MZ AHU provides cooling only to the southeast classroom; 2,610 cfm at 3 hp	Fair condition
AHU-2	MZ	MZ AHU provides cooling only to the northwest classroom; 4,850 cfm at 5 hp	Fair condition
AHU-3	MZ	MZ AHU provides cooling only to the northeast administrative offices; 2,610 cfm at 3 hp	Fair condition
RAD-1	HW baseboard radiation	Perimeter radiation provides heating throughout the building	Fair condition
	Chilled Water	Chilled Water is provided by a Central Chiller Plant	
CWP-1	CW pump	1 hp pump serves MZ AHUs	Fair condition
	Steam	Steam is provided by a Central Boiler Plant	
CV-1	STM/HW Converter	CV-1 provides HW to RAD-1	Fair condition
HWP-1	HW pump	1-1/2 hp pump serves CV-1 and RAD-1	Fair condition

4.34.2 HVAC System Components for Repair

The HVAC system components for Building 8025 were observed to be in fair condition and are not in need of repair.

4.34.3 Proposed HVAC System Replacement

The three MZ AHUs serving Building 8025 were considered for conversion to VAV AHUs. The existing MZ AHUs will be modified as follows:

- VSD controllers will be installed on the MZ AHUs to control the supply fan speed.

- MZ AHUs have zone dampers for the hot decks and cold decks. The pneumatic actuators on the hot and cold deck zone dampers will be retrofitted with electric actuators and VAV terminal unit controllers. The retrofitted dampers will vary the airflow rate to each zone.

- Summer-Winter changeover switch will be installed to close the retrofitted dampers on the hot and cold decks during heating or cooling seasons. The hot deck damper will close during the cooling season, and the cold deck damper will close during the heating season.

- Thermostats will be installed in each zone; the thermostats will reset the VAV terminal unit controllers that vary the supply air to the zones.

Method of Analysis

The approach used for calculating energy savings included using a computer program to simulate a typical building. The EZDOE computer model for Building 7108 (Battalion Admin. and Classroom) was used to evaluate energy savings for the proposed HVAC system replacement. Building 7108 is similar to Building 8025.

The analysis proceeded as follows:

- The computer model for Building 7108 was used for the baseline computer model.

- The baseline computer model was modified to include the HVAC replacement system - the MZ AHUs converted to VAV AHUs with VSDs. The modified baseline is the ECO model.

- The ECO model energy use was subtracted from the baseline energy use to find the energy savings for natural gas and electricity.

- A construction cost was developed for the proposed HVAC system replacement.

- The energy savings and the construction cost were entered into a LCCA worksheet. The economic life for the LCCA is 20 years.

Energy Savings and Economic Analysis

The energy savings and economic analysis for the proposed HVAC system replacement are included in Appendix D. The results of the analysis are presented in the following table.

Item	HVAC System Replacement Energy Savings and Economics
Annual Electric Energy Savings (MBtu)	65
Annual Electric Demand Savings ($)	(112)
Annual Natural Gas Savings (MBtu)	0
Total Annual Energy Cost Savings	$679
Investment Cost	$17,282
Annual Maintenance Cost Savings	$0
Non-recurring Cost Savings	$0
Savings-to-Investment Ratio (SIR)	0.63
Simple Payback (yrs)	25.45

4.34.4 Recommendations

The HVAC systems are not recommended for repair or replacement.

4.35 BUILDING 3 (POST CHAPEL)

4.35.1 HVAC System Existing Conditions

Building 3 is a 8,828 sq ft, one-story building with a conditioned basement. It was constructed in 1875 and has sandstone block foundations and walls. The Post Chapel has a sanctuary and sacristy on ground level with classrooms and a kitchen area in the basement. A H&V Unit and a cooling-only SZ AHU are connected to the same supply air ductwork, and provide heating and cooling to the entire building. A manual air damper can be set for either summer or winter operation. It is estimated that most of the HVAC equipment was installed during the early 1970s.

The following table describes the HVAC equipment serving Building 3.

HVAC System No.	HVAC System Type	Description of HVAC System	Existing Condition
AHU-1	SZ	SZ AHU provides cooling to the entire building; SZ AHU is a packaged unit with a DX coil and compressor unit; 3/4 hp and approx. 4,800 cfm	Fair condition
H&V-1	H&V Unit	H&V Unit provides heating and ventilation air to the entire building; 3 hp and 5,000 cfm	Fair condition - very old
CT-1	Cooling Tower	Water cooling tower serves AHU-1	Poor condition - severe corrosion
BLR-1	STM Boiler	600,000 Btuh (output) Steam Boiler serves AHU-1 and H&V-1	Fair condition - very old

4.35.2 HVAC System Components for Repair

The AHU-1, H&V-1, BLR-1 system components were observed to be generally in fair condition. The CT-1 has severe corrosion, is beyond repair, and should be replaced.

4.35.3 Proposed HVAC System Replacement

All the HVAC equipment is recommended for replacement. AHU-1 and H&V-1 will be replaced with a VAV AHU serving three zones. The cooling tower and boiler will be replaced with more efficient equipment. The following equipment and materials are included in the proposed HVAC system replacement:

- VAV AHU with VSD.

- Three VAV terminal units with reheat coils will be installed on existing ductwork. Three zones will be served by the VAV terminal units: west half of sanctuary and basement, east half of sanctuary and basement, and the sacristy at the north end of the building.

- HW boiler will be installed to provide hot water.

- Air cooled chiller will be installed to provide chilled water.

Method of Analysis

The approach used for calculating energy savings included using a computer program to simulate a typical building. The EZDOE computer model for Building 6 (Post Chapel) was used to evaluate energy savings for the proposed HVAC system replacement.

The analysis proceeded as follows:

- The computer model for Building 6 was used as the baseline computer model. It was modified to simulate the existing HVAC systems in Building 3.

- The baseline computer model was modified to include the HVAC replacement systems - the VAV AHU, the HW boiler, and the air cooled water chiller. The modified baseline is the ECO model.

- The ECO model energy use was subtracted from the baseline energy use to find the energy savings for natural gas and electricity. Energy savings were prorated on a sq ft basis to Building 3.

- A construction cost was developed for the proposed HVAC system replacement.

- The energy savings and the construction cost were entered into a LCCA worksheet. Additional information entered into the LCCA worksheet included the following:

  - Economic life is 20 years.

  - Annual maintenance costs were calculated using estimated labor hours and materials.

  - Avoided cost of existing system replacement was included as a non-recurring fifth year cost.

Energy Savings and Economic Analysis

The energy savings and economic analysis for the proposed HVAC system replacement are included in Appendix D. The results of the analysis are presented in the following table.

Item	HVAC System Replacement Energy Savings and Economics
Annual Electric Energy Savings (MBtu)	136
Annual Electric Demand Savings ($)	131
Annual Natural Gas Savings (MBtu)	212
Total Annual Energy Cost Savings	$2,653
Investment Cost	$68,200
Annual Maintenance Cost Savings	$724
Non-recurring Cost Savings	$48,583
Savings-to-Investment Ratio (SIR)	1.42
Simple Payback (yrs)	11.75

4.35.4 Recommendations

The proposed HVAC system replacement is not recommended.

4.36 BUILDING 7086 (UNIT CHAPEL)

4.36.1 HVAC System Existing Conditions

Building 7086 is a 8,700 sq ft, one-story building. The building was built in 1957 and is constructed of face brick and concrete block. The building is divided into two functional areas, the church sanctuary and the administration offices. The administration offices are heated and cooled by FCs. The church sanctuary is heated and cooled by a large SZ AHU.

The following table describes the HVAC equipment serving Building 7086

HVAC System No.	HVAC System Type	Description of HVAC System	Existing Condition
FC-1 through FC-11	Two-pipe fan coil	Four dual-temperature FCs provide heating and cooling to the administration offices; a total of 11 FCs serve this area of building	Fair condition
AHU-1	SZ	SZ AHU provides heating and cooling to the church sanctuary; 5,400 cfm at 3 hp	Fair condition
ACCU-1	Air Cooled Condensing Unit	20 Ton ACCU serves SZ AHU with DX coil	Fair condition
CH-1-2	Reciprocating w/ Air Cooled Cond. - Split System	10 Ton chiller serves FCs	Fair condition
BLR-1	HW Boiler	907,000 BTUH (output) boiler serves FCs and SZ AHU	Fair condition
DTWP-1	Dual Temperature Water pump	1.5 hp pump serves BLR-1 and FCs	Fair condition
DTWP-2	Dual Temperature Water pump	3/4 hp pump serves BLR-1 and SZ AHU	Fair condition

4.36.2 HVAC System Components for Repair

The HVAC system components were observed to be in fair condition and are not in need of repair.

4.36.3 Proposed HVAC System Replacement

The SZ AHU serving the church sanctuary in Building 7086 was considered for replacement with a VAV AHU. The following equipment and materials are included in the proposed HVAC system replacement:

- VAV AHU with VSD.

- Two VAV terminal units with reheat coils will be installed on existing ductwork. The two zones served by the VAV terminal units are the north half and south half of the church sanctuary.

- Thermostats will be installed in each zone; the thermostats will reset the VAV terminal unit controllers that vary the supply air to the zone.

Method of Analysis

The EZDOE computer model for Building 7086 was used to evaluate energy savings for the proposed HVAC system replacement.

The analysis proceeded as follows:

- The computer model for Building 7086 was used as the baseline computer model.

  The baseline computer model was modified to include the HVAC replacement systems - the VAV AHU with VSD. The modified baseline is the ECO model. The following system parameters were also included:

  - Supply air volume varies down to only 50%, to avoid DX coil freeze up.

  - VAV terminal units vary supply air volume down to 20%.

  - Supply fan utilizes a bypass when VAV terminal units vary supply air volume below 50%.

- The ECO model energy use was subtracted from the baseline energy use to find the energy savings for natural gas and electricity.

- A construction cost was developed for the proposed HVAC system replacement.

- The energy savings and the construction cost were entered into a LCCA worksheet. Additional information entered into the LCCA worksheet included the following:

  - Economic life is 20 years.

  - Avoided cost of existing system replacement was included as a non-recurring fifth year cost.

Energy Savings and Economic Analysis

The energy savings and economic analysis for the proposed HVAC system replacement are included in Appendix D. The results of the analysis are presented in the following table.

Item	HVAC System Replacement Energy Savings and Economics
Annual Electric Energy Savings (MBtu)	92
Annual Electric Demand Savings ($)	183
Annual Natural Gas Savings (MBtu)	122
Total Annual Energy Cost Savings	$1,794
Investment Cost	$19,280
Annual Maintenance Cost Savings	$0
Non-recurring Cost Savings	$12,554
Savings-to-Investment Ratio (SIR)	2.09
Simple Payback (yrs)	7.96

4.36.4 Recommendations

The proposed HVAC system replacement is recommended.

4.37 BUILDING 602 (DENTAL CLINIC)

4.37.1 HVAC System Existing Conditions

Building 602 is a 11,560 sq ft, one-story building. It was built in 1979 and is constructed of poured concrete foundations and walls. The dental clinic is heated and cooled by a dual duct (DD) AHU. Finned tube radiation units at the perimeter of the building provide additional heating.

The following table describes the HVAC equipment serving Building 602.

HVAC System No.	HVAC System Type	Description of HVAC System	Existing Condition
AHU-1	Dual Duct	DD AHU with 42 mixing boxes provides heating and cooling to the entire building; 13,900 cfm at 25 hp	Fair condition
RAD-1	HW Finned tube radiation	Finned tube radiation units provide additional heating along the perimeter of the building	Fair condition
CH-1	Reciprocating w/ Air Cooled Cond.	78 Ton chiller serves the DD AHU	Fair condition
CWP-1	CW pump	2 hp pump serves CH-1 and DD AHU	Fair condition
BLR-1	Steam boiler	506,000 Btuh (output) steam boiler serves AHU-1 and RAD-1	Fair condition
CV-1	STM/HW Converter	STM/HW converter provides HW to AHU-1 and RAD-1	Fair condition
HWP-1	HW pump	1/4 hp pump serves AHU-1 and RAD-1	Fair condition

4.37.2 HVAC System Components for Repair

The HVAC system components were observed to be generally in fair condition and are not in need of repair.

4.37.3 Proposed HVAC System Replacement

The DD AHU serving Building 602 was considered for conversion to a VAV AHU. The following equipment and materials will be included in the proposed HVAC system replacement:

- DD AHU will be converted to a VAV DD AHU; a VSD will be installed.

- Existing ductwork will remain; the existing mixing boxes will be replaced with dual duct VAV terminal units.

- Thermostats will be installed in each zone; the thermostats will reset the VAV terminal unit controllers that vary the supply air to the zone.

Method of Analysis

The approach used for calculating energy savings included using a computer program to simulate a typical building. The EZDOE computer model for Building 7665 (Dental Clinic) was used to evaluate energy savings for the proposed HVAC system replacement in Building 602. The computer model building is similar in use and construction to Building 602.

The analysis proceeded as follows:

- The computer model for Building 7665 was modified to simulate the existing HVAC systems in Building 602. This computer model was used as the baseline.

- The baseline computer model was modified to include the proposed HVAC system replacement - the dual duct VAV AHU with VSD. The supply air volume varies down to 20%. The modified baseline is the ECO model.

- The ECO model energy use was subtracted from the baseline energy use to find the energy savings for natural gas and electricity. The energy savings were prorated on a square foot basis to derive the energy savings for Building 602.

- A construction cost was developed for the proposed HVAC system replacement.

- The energy savings and the construction cost were entered into a LCCA worksheet. The economic life for the LCCA worksheet is 20 years.

Energy Savings and Economic Analysis

The energy savings and economic analysis for the proposed HVAC system replacement are included in Appendix D. The results of the analysis are presented in the following table.

Item	HVAC System Replacement Energy Savings and Economics
Annual Electric Energy Savings (MBtu)	681
Annual Electric Demand Savings ($)	1,242
Annual Natural Gas Savings (MBtu)	(132)
Total Annual Energy Cost Savings	$8,934
Investment Cost	$35,342
Annual Maintenance Cost Savings	$0
Non-recurring Cost Savings	$0
Savings-to-Investment Ratio (SIR)	3.94
Simple Payback (yrs)	3.96

4.37.4 Recommendations

The proposed HVAC system replacement is recommended.

4.38 BUILDING 7665 (DENTAL CLINIC)

4.38.1 HVAC System Existing Conditions

Building 7665 is a 11,080 sq ft, one-story building. It was built in 1965 and is constructed of face brick and concrete block. The dental clinic is heated and cooled by a six zone MZ AHU.

The following table describes the HVAC equipment serving Building 7665.

HVAC System No.	HVAC System Type	Description of HVAC System	Existing Condition
AHU-1	MZ	MZ AHU (6 zones) provides heating and cooling to the entire building; 19,500 cfm at 15 hp	Fair condition
CH-1	Two Reciprocating Compressors	50 Ton chiller serves the MZ AHU	Fair condition
CT-1	Cooling Tower - Water	55 Ton Cooling Tower serves CH-1; 5 hp fan	Fair condition
CNWP-1	Condenser Water Pump	Condenser water pump serves CT-1; 5 hp pump	Fair condition
BLR-1	Steam boiler	650,000 Btuh (output) Steam boiler serves AHU-1	Fair condition

4.38.2 HVAC System Components for Repair

The HVAC system components were observed to be generally in fair condition and are not in need of repair.

4.38.3 Proposed HVAC System Replacement

The MZ AHU serving Building 7665 was considered for conversion to a VAV AHU. The following equipment and materials will be included in the proposed HVAC system replacement:

- VSD will be installed on the MZ AHU.
- Existing ductwork will remain; VAV terminal units with reheat coils will be installed on the zone supply air ducts.
- Thermostats will be installed in each zone; the thermostats will reset the VAV terminal unit controllers that vary the supply air to the zone.

Method of Analysis

The EZDOE computer model for Building 7665 was used to evaluate energy savings for the proposed HVAC system replacement. The analysis proceeded as follows:

- The computer model for Building 7665 was used for the baseline computer model.
- The baseline computer model was modified to include the proposed HVAC system with a VSD. The modified baseline is the ECO model. The following system parameters were also included:
  - Supply air volume varies down to only 50%, to avoid DX coil freeze up.
  - Dual duct VAV terminal units vary supply air volume down to 20%.
  - Supply fan utilizes a bypass when VAV terminal units vary supply air volume below 50%.
- The ECO model energy use was subtracted from the baseline energy use to find the energy savings for natural gas and electricity.
- A construction cost was developed for the proposed HVAC system replacement.
- The energy savings and the construction cost were entered into a LCCA worksheet. The economic life of the LCCA worksheet is 20 years.

Energy Savings and Economic Analysis

The energy savings and economic analysis for the proposed HVAC system replacement are included in Appendix D. The results of the analysis are presented in the following table.

Item	HVAC System Replacement Energy Savings and Economics
Annual Electric Energy Savings (MBtu)	301
Annual Electric Demand Savings ($)	637
Annual Natural Gas Savings (MBtu)	(107)
Total Annual Energy Cost Savings	$3,834
Investment Cost	$12,210
Annual Maintenance Cost Savings	$0
Non-recurring Cost Savings	$0
Savings-to-Investment Ratio (SIR)	4.85
Simple Payback (yrs)	3.18

4.38.4 Recommendations

The proposed HVAC system replacement is recommended.

4.39 BUILDING 7670 (DENTAL CLINIC)

4.39.1 HVAC System Existing Conditions

Building 7670 is a 14,960 sq ft, one-story building. It was built in 1976 and is constructed of face brick and concrete block walls. The dental clinic is heated and cooled by a DD AHU. Finned tube radiation units at the perimeter of the building provide additional heating.

The following table describes the HVAC equipment serving Building 7670.

HVAC System No.	HVAC System Type	Description of HVAC System	Existing Condition
AHU-1	DD	DD AHU with 50 mixing boxes provides heating and cooling to the entire building; 25,400 cfm at 7.5 hp; 7.5 hp return air fan	Fair condition
RAD-1	HW Finned tube radiation	Finned tube radiation units provide additional heating along the perimeter of the building	Fair condition
CH-1	Reciprocating w/ Air Cooled Cond.	83 Ton chiller serves the DD AHU	Fair condition
CWP-1	CW pump	2 hp pump serves CH-1 and DD AHU	Fair condition
BLR-1	Steam boiler	782,000 Btuh (output) steam boiler serves AHU-1 and RAD-1	Good condition
CV-1	STM/HW Converter	STM/HW converter provides HW to AHU-1 and RAD-1	Fair condition
HWP-1	HW pump	1/2 hp pump serves AHU-1 and RAD-1	Fair condition

4.39.2 HVAC System Components for Repair

The HVAC system components were observed to be in fair condition and are not in need of repair.

4.39.3 Proposed HVAC System Replacement

The DD AHU serving Building 7670 was considered for conversion to a VAV AHU. The following equipment and materials will be included in the proposed HVAC system replacement:

- DD AHU will be converted to a VAV AHU; a VSD will be installed to control the supply and return fan speed.

- Existing ductwork will remain; the existing mixing boxes will be replaced with dual duct VAV terminal units.

- Thermostats will be installed in each zone; the thermostats will reset the VAV terminal unit controllers that vary the supply air to the zone.

Method of Analysis

The approach used for calculating energy savings included using a computer program to simulate a typical building. The EZDOE computer model for Building 7665 (Dental Clinic) was used to evaluate energy savings for the proposed HVAC system replacement in Building 7670. The computer model building is similar in use and construction to Building 7670.

The analysis proceeded as follows:

- The computer model for Building 7665 was modified to simulate the existing HVAC systems in Building 7670. This computer model was used as the baseline.

- The baseline computer model was modified to include the proposed HVAC system replacement - the dual duct VAV AHU with VSD. The supply air volume varies down to 20%. The modified baseline is the ECO model.

- The ECO model energy use was subtracted from the baseline energy use to find the energy savings for natural gas and electricity. The energy savings were prorated on a square foot basis to derive the energy savings for Building 7670.

- A construction cost was developed for the proposed HVAC system replacement.

- The energy savings and the construction cost were entered into a LCCA worksheet. The economic life for the LCCA worksheet is 20 years.

Energy Savings and Economic Analysis

The energy savings and economic analysis for the proposed HVAC system replacement are included in Appendix D. The results of the analysis are presented in the following table.

Item	HVAC System Replacement Energy Savings and Economics
Annual Electric Energy Savings (MBtu)	889
Annual Electric Demand Savings ($)	958
Annual Natural Gas Savings (MBtu)	(173)
Total Annual Energy Cost Savings	$11,006
Investment Cost	$40,355
Annual Maintenance Cost Savings	$0
Non-recurring Cost Savings	$0
Savings-to-Investment Ratio (SIR)	4.26
Simple Payback (yrs)	3.67

4.39.4 Recommendations

The proposed HVAC system replacement is recommended.

4.40 BUILDING 7245 (ENLISTED PERSONNEL DINING)

4.40.1 HVAC System Existing Conditions

Building 7245 is a 14,000 sq ft, one-story building. The building was built during the late 1950s and is constructed of face brick and concrete block. It is has a dining hall area and a kitchen area. The mechanical equipment room is located in a mezzanine above the kitchen area. Two SZ AHUs provide heating and cooling to the dining hall area. Finned tube radiation units at the perimeter of the dining hall area provide additional heating. Three MAUs provide heating to the kitchen area and make-up air for the kitchen exhaust hoods.

The following table describes the HVAC equipment serving Building 7245.

HVAC System No.	HVAC System Type	Description of HVAC System	Existing Condition
AHU-1	SZ	SZ AHU provides heating and cooling to half of the dining hall area; 7,000 cfm at 5 hp	Poor condition - 2" cooling coil 3-way control valve is inoperable
AHU-2	SZ	SZ AHU provides heating and cooling to the other half of the dining hall area; 7,250 cfm at 5 hp	Poor condition
MAU-1	MAU	MAU-1 provides heating and make-up air to the kitchen area; 11,400 cfm at 5 hp	Poor condition - OA damper actuator linkage disconnected; inoperable
MAU-2	MAU	MAU-2 provides heating and make-up air to the kitchen area; 3,600 cfm at 1.5 hp	Poor condition
MAU-3	MAU	MAU-3 provides heating and make-up air to the kitchen area; 1,000 cfm at 1 hp	Poor condition - OA damper actuator linkage disconnected; inoperable
RAD-1	HW Finned Tube Radiation	HW finned tube radiation units provide heating along the perimeter of the dining hall area	Fair condition
	Chilled Water to the SZ AHUs	Chilled water is provided by a Central Chiller Plant	
CWP-1	CW pump	5 hp pump serves AHU-1 and AHU-2	Fair condition
BLR-1	Steam Boiler	Steam boiler serves SZ AHUs, MAUs, CV-1, and kitchen equipment (6,900,000 Btuh output)	Fair condition
CV-1	STM/HW Converter	STM/HW converter provides HW to RAD-1	Fair condition
HWP-1	HW pump	1/2 hp pump serves RAD-1	Fair condition

4.40.2 HVAC System Components for Repair

The HVAC system components were observed to be in poor to fair condition. The HVAC system components in need of immediate repair are listed in the following table, with the repair costs.

HVAC System No.	HVAC System Type	Description of HVAC System Component for Repair	Repair Cost ($)
AHU-1	SZ	2" CW control valve actuator inoperable - replace entire valve	426
MAU-1	MAU	OA damper actuator linkage is disconnected; damper actuator is inoperable - replace entire assembly	223
MAU-3	MAU	OA damper actuator linkage is disconnected; damper actuator is inoperable - replace entire assembly	223
		Total Repair Cost	872

4.40.3 Proposed HVAC System Replacement

The SZ AHUs and the MAUs serving Building 7245 were considered for replacement. The SZ AHUs will be replaced with VAV AHU systems each serving half of the dining area. The MAUs will be replaced with Heat Recovery Unit (HRU) systems each serving half of the kitchen area. The following equipment and materials are included in the proposed HVAC systems replacement:

- VAV AHUs with VSDs will replace the SZ AHUs.
- VAV terminal units with reheat coils will be installed on the zone supply air ducts.
- Thermostats will be installed in each zone; the thermostats will reset the VAV terminal unit controllers that vary the supply air to the zones.
- HRUs will replace MAU-1 and MAU-2.
- Exhaust fans interlocked with MAU-1 and MAU-2 will be removed. Exhaust ductwork will be modified, added to, and connected to the exhaust fan outlets and inlets on the HRUs.

Method of Analysis

The EZDOE computer models for Building 7245 were used to evaluate energy savings for the proposed HVAC system replacement.

The analysis proceeded as follows:

- The computer models, one for the dining area and one for the kitchen area in Building 7245 were used as the baseline computer models.

- The baseline computer models were modified to include the HVAC replacement systems - the VAV AHUs and the HRUs. The modified baselines are the ECO models. The ECO models included additional modifications as follows:

  - VAV controls vary the supply air volume down to 20%.

  - HRU heat recovery of exhaust air functions at 70% efficiency.

- The ECO models energy use was subtracted from the baselines energy use to find the energy savings for natural gas and electricity.

- Construction costs were developed for the proposed HVAC system replacements.

- The energy savings and the construction cost were entered into LCCA worksheets. Additional information entered into the LCCA worksheets included the following:

  - Economic life is 20 years.

  - Avoided cost of existing system replacement was included as a non-recurring fifth year cost.

<u>Energy Savings and Economic Analysis</u>

The energy savings and economic analysis for the proposed HVAC system replacement for the SZ AHUs serving the dining area are included in Appendix D. The results of the analysis are presented in the following table.

Replace SZ AHUs in Dining Area with VAV AHUs

Item	HVAC System Replacement Energy Savings and Economics
Annual Electric Energy Savings (MBtu)	287
Annual Electric Demand Savings ($)	381
Annual Natural Gas Savings (MBtu)	(279)
Total Annual Energy Cost Savings	$2,707
Investment Cost	$33,387
Annual Maintenance Cost Savings	$0
Non-recurring Cost Savings	$21,050
Savings-to-Investment Ratio (SIR)	1.74
Simple Payback (yrs)	8.88

The energy savings and economic analysis for the proposed HVAC system replacement for the MAUs serving the kitchen are included in Appendix D. The results of the analysis are presented in the following table.

Replace MAUs with HRUs

Item	HVAC System Replacement Energy Savings and Economics
Annual Electric Energy Savings (MBtu)	103
Annual Electric Demand Savings ($)	332
Annual Natural Gas Savings (MBtu)	3,511
Total Annual Energy Cost Savings	$16,047
Investment Cost	$90,334
Annual Maintenance Cost Savings	$0
Non-recurring Cost Savings	$30,377
Savings-to-Investment Ratio (SIR)	3.49
Simple Payback (yrs)	5.14

4.40.4 Evaluation of Dedicated Boilers for Service Water Heating

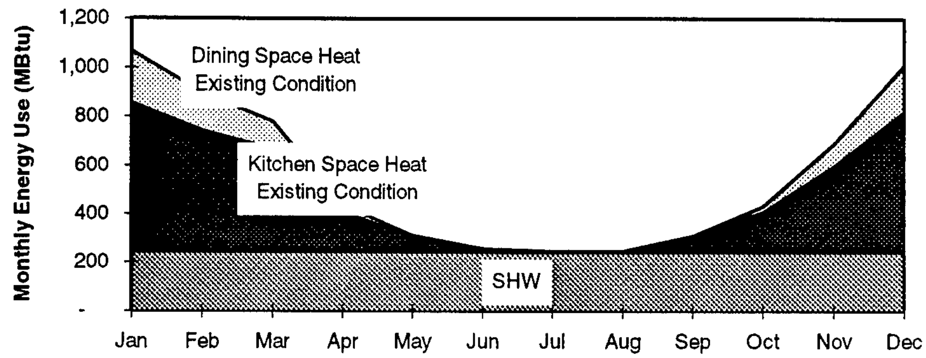
Proposed Modification

It is proposed to replace a steam boiler serving both space heating and service water heating (SWH) loads with separate dedicated boilers for each of the loads. The existing steam boiler serving combined loads operates at a low part load ratio. At low part load ratios, boilers have poor operating efficiencies, especially during the summer months when space heating is not required. The advantage of dedicated boilers for each load is that the space heat boiler may be shut off during the summer months, and the SWH boiler will operate with better efficiency if properly sized to the SWH load. These proposed modifications are applicable to any building which uses a single boiler for both space heating and SWH heating.

Analysis

Building 7245, an Enlisted Personnel Dining Facility, was selected for evaluation. This building has a single 6,900,000 Btuh output steam boiler which serves both space heating and HW heating loads. Analysis indicates that the actual peak demands are 1,772,000 Btuh and 1,645,000 Btuh for space heating and SWH heating, respectively. Monthly energy use profiles are indicated in the following figure.

Annual Load Profile

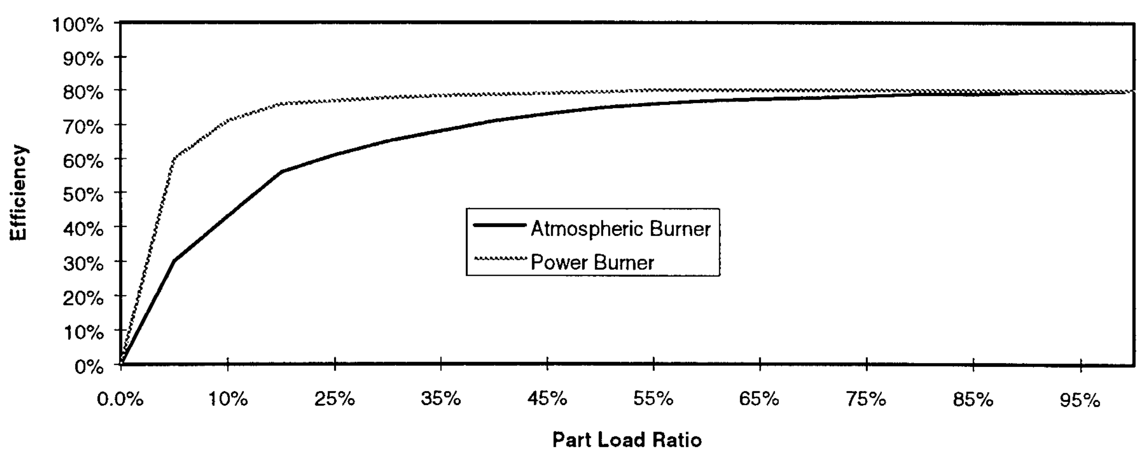


Monthly energy use varies from a maximum of about 1,100 MBtu to a minimum of about 250 Mbtu.

It is proposed to provide a dedicated 2,000,000 Btuh steam boiler for SHW which would be used throughout the year and a second 2,000,000 Btuh HW boiler for space heating which would be used from October through April for space heating.

The amount of energy savings resulting from this strategy is highly dependent on the efficiency of the boiler at part load conditions. The following figure presents a range of boiler efficiency at varying part loads.

Boiler Efficiency Curves



The lower curve represents the efficiency of a boiler with an atmospheric burner. Boilers with atmospheric burners have no control on the amount of air moving through the boiler. Atmospheric burners cycle on and off in response to the load. During off periods, air

continues to flow through the boiler carrying heat carrying heat from the hot water or steam in the boiler up the stack where it is lost to the atmosphere.

The higher curve represents the efficiency of a boiler with a power burner or a burner which controls air flow through the boiler. The power burner boiler has a much better efficiency curve.

Annual energy use calculations consisted of:

- Establishing an annual load profile
- Calculating part load ratios based on monthly loads and boiler capacity
- Looking up the boiler efficiency corresponding to the part load ratio
- Calculatiing monthly boiler energy use and summing for the annual energy use.

The existing steam boiler in Building 7245 is equipped with a power burner. The heat output of this boiler is nearly twice the peak heating demand on the boiler. The analysis indicates that the monthly part load ratio varies from 21% in January to less than 5% in the summer months.

The proposed SHW steam boiler would operate with a monthly part load ratio of 17%. The SWH load is highly variable, ranging from 1.5 gallons per meal for the peak use hours to a zero load at night. The proposed space heating HW boiler would operate with a monthly part load ratio ranging from 13% to 57% during the heating season, and be turned off during the summer season.

Energy Savings and Economic Analysis

The energy savings and economic analysis for the proposed boiler replacement are included in Appendix D. The results of the analysis are presented in the following table.

Replace Large Steam Boiler with Smaller Steam and Hot Water Boilers

Item	HVAC System Replacement Energy Savings and Economics
Annual Electric Energy Savings (MBtu)	(111)
Annual Electric Demand Savings ($)	0
Annual Natural Gas Savings (MBtu)	1,528
Total Annual Energy Cost Savings	$4,957
Investment Cost	$72,585
Annual Maintenance Cost Savings	($181)
Non-recurring Cost Savings	$101,942
Savings-to-Investment Ratio (SIR)	2.47
Simple Payback (yrs)	7.35

4.40.5 Recommendations

The proposed HVAC system replacements and the proposed boiler replacement are recommended.

4.41 BUILDING 7606 (ENLISTED PERSONNEL DINING)

4.41.1 HVAC System Existing Conditions

Building 7606 is a 13,500 sq ft , one-story building. The building was built during the late 1950s and is constructed of face brick and concrete block. It is has a dining hall area and a kitchen area. The mechanical equipment room is located in a mezzanine above the kitchen area. Two SZ AHUs provide heating and cooling to the dining hall area. Finned tube radiation units at the perimeter of the dining hall area provide additional heating. Two MAUs provide heating to the kitchen area and make-up air for the kitchen exhaust hoods.

The following table describes the HVAC equipment serving Building 7606.

HVAC System No.	HVAC System Type	Description of HVAC System	Existing Condition
AHU-1	SZ	SZ AHU provides heating and cooling to half of the dining hall area; 7,000 cfm at 5 hp	Poor condition - 2" cooling coil 3-way control valve is inoperable
AHU-2	SZ	SZ AHU provides heating and cooling to the other half of the dining hall area; 7,250 cfm at 5 hp	Poor condition - 2" cooling coil 3-way control valve is inoperable
MAU-1	MAU	MAU-1 provides heating and make-up air to the kitchen area; 11,400 cfm at 5 hp	Poor condition
MAU-2	MAU	MAU-2 provides heating and make-up air to the kitchen area; 3,600 cfm at 1.5 hp	Poor condition
RAD-1	HW Finned Tube Radiation	HW finned tube radiation units provide heating along the perimeter of the dining hall area	Fair condition
CH-1	Reciprocating w/ Air Cooled Cond.	70 Ton chiller serves the SZ AHUs	Fair condition
CWP-1	CW pump	5 hp pump serves CH-1, AHU-1, and AHU-2	Fair condition
BLR-1	Steam Boiler	Steam boiler serves SZ AHUs, MAUs, CV-1, and kitchen equipment (6,900,000 Btuh output)	Fair condition
CDP-1	Steam condensate pump	2 hp condensate pump - pumps condensate from heating equipment back to boiler	Fair condition - does not operate
CV-1	STM/HW Converter	STM/HW converter provides HW to RAD-1	Fair condition
HWP-1	HW pump	1/2 hp pump serves RAD-1	Fair condition

4.41.2 HVAC System Components for Repair

The HVAC system components were observed to be in poor to fair condition. The HVAC system components in need of immediate repair are listed in the following table, with the repair costs.

HVAC System No.	HVAC System Type	Description of HVAC System Component for Repair	Repair Cost ($)
AHU-1	SZ	2" CW control valve actuator inoperable - replace entire valve	426
AHU-2	SZ	2" CW control valve actuator inoperable - replace entire valve	426
CDP-1	Steam condensate return pump	New steam condensate return pump does not operate; Replace motor	1,011
		Total Repair Cost	1,863

4.41.3 Proposed HVAC System Replacement

The SZ AHUs and the MAUs serving building 7606 were considered for replacement. The SZ AHUs will be replaced with VAV AHU systems each serving half of the dining area. The MAUs will be replaced with Heat Recovery Unit (HRU) systems each serving half of the kitchen area. The following equipment and materials are included in the proposed HVAC systems replacement:

- VAV AHUs with VSDs will replace the SZ AHUs.
- VAV terminal units with reheat coils will be installed on the zone supply air ducts.
- Thermostats will be installed in each zone; the thermostats will reset the VAV terminal unit controllers that vary the supply air to the zones.
- HRUs will replace MAU-1 and MAU-2.
- Exhaust fans interlocked with MAU-1 and MAU-2 will be removed. Exhaust ductwork will be modified, added, and connected to the exhaust fan outlets and inlets on the HRUs.

Method of Analysis

The EZDOE computer model for the proposed HVAC system replacements in Building 7245 was used to calculate energy savings for Building 7606. The proposed HVAC system replacements in Building 7606 are identical to Building 7245.

The analysis proceeded as follows:

- The energy savings for natural gas and electricity were taken from the HVAC systems replacement analysis in Building 7245.
- Construction costs was developed for the proposed HVAC system replacements.
- The energy savings and the construction cost were entered into a LCCA worksheet. Additional information entered into the LCCA worksheet included the following:
  - Economic life is 20 years.
  - Annual maintenance costs were calculated using estimated labor hours and materials.
  - Avoided cost of existing system replacement was included as a non-recurring first year cost.

Energy Savings and Economic Analysis

The energy savings and economic analysis for the proposed HVAC system replacement for the SZ AHUs serving the dining area are included in Appendix D. The results of the analysis are presented in the following table.

Replace SZ AHUs in Dining Area with VAV AHUs

Item	HVAC System Replacement Energy Savings and Economics
Annual Electric Energy Savings (MBtu)	287
Annual Electric Demand Savings ($)	381
Annual Natural Gas Savings (MBtu)	(279)
Total Annual Energy Cost Savings	$2,707
Investment Cost	$33,387
Annual Maintenance Cost Savings	$0
Non-recurring Cost Savings	$21,050
Savings-to-Investment Ratio (SIR)	1.74
Simple Payback (yrs)	8.88

The energy savings and economic analysis for the proposed HVAC system replacement for the MAUs serving the kitchen are included in Appendix D. The results of the analysis are presented in the following table.

Replace MAUs with HRUs

Item	HVAC System Replacement Energy Savings and Economics
Annual Electric Energy Savings (MBtu)	103
Annual Electric Demand Savings ($)	332
Annual Natural Gas Savings (MBtu)	3,511
Total Annual Energy Cost Savings	$16,047
Investment Cost	$90,334
Annual Maintenance Cost Savings	$0
Non-recurring Cost Savings	$30,377
Savings-to-Investment Ratio (SIR)	3.49
Simple Payback (yrs)	5.14

4.41.4 Evaluation of Dedicated Boilers for Space Heating and Service Water Heating

Proposed Modification

The steam boiler serving Building 7606 is used for both space heating and service water heating (SWH) loads. The steam boiler, serving the combined loads, operates at a low part load ratio. At the low part load ratio, the boiler has poor operating efficiencies, especially during the summer months when space heating is not required. The advantage of dedicated boilers for each load is that the space heat boiler may be shut off during the summer months, and the SWH boiler will operate with better efficiency if properly sized to the SWH load. Dedicated boilers were considered for replacement of the existing steam boiler.

Analysis

Building 7245, an Enlisted Personnel Dining Facility, was selected for evaluation (Section 4.40.4). This building has a 6,900,000 Btuh output steam boiler which serves both space heating and SWH heating loads. Building 7606 is identical to Building 7245. The energy savings for the proposed boiler replacement in Building 7606 were taken from the evaluation in Building 7245.

Energy Savings and Economic Analysis

The energy savings and economic analysis for the proposed boiler replacement are included in Appendix D calculations for Building 7245. The results of the analysis are presented in the following table.

Replace Large Steam Boiler with Smaller Steam Hot Water Boilers

Item	HVAC System Replacement Energy Savings and Economics
Annual Electric Energy Savings (MBtu)	(111)
Annual Electric Demand Savings ($)	0
Annual Natural Gas Savings (MBtu)	1,528
Total Annual Energy Cost Savings	$4,957
Investment Cost	$89,312
Annual Maintenance Cost Savings	($181)
Non-recurring Cost Savings	$101,942
Savings-to-Investment Ratio (SIR)	2.01
Simple Payback (yrs)	9.05

4.41.5 Recommendations

The proposed HVAC system replacements and the proposed boiler replacement are recommended.

4.42 BUILDING 7654 (ENLISTED PERSONNEL DINING)

4.42.1 HVAC System Existing Conditions

Building 7654 is a 13,500 sq.ft., one-story building. The building was built during the late 1950s and is constructed of face brick and concrete block. It is has a dining hall area and a kitchen area. The mechanical equipment room is located in a mezzanine above the kitchen area. Two SZ AHUs provide heating and cooling to the dining hall area. Finned tube radiation units at the perimeter of the dining hall area provide additional heating. Two MAUs provide heating to the kitchen area and make-up air for the kitchen exhaust hoods.

The following table describes the HVAC equipment serving Building 7654.

HVAC System No.	HVAC System Type	Description of HVAC System	Existing Condition
AHU-1	SZ	SZ AHU provides heating and cooling to half of the dining hall area; 7,000 cfm at 5 hp	Poor condition - 2" cooling coil 3-way control valve is inoperable
AHU-2	SZ	SZ AHU provides heating and cooling to the other half of the dining hall area; 7,250 cfm at 5 hp	Poor condition - OA damper actuator linkage disconnected; inoperable
MAU-1	MAU	MAU-1 provides heating and make-up air to the kitchen area; 11,400 cfm at 5 hp	Poor condition
MAU-2	MAU	MAU-2 provides heating and make-up air to the kitchen area; 3,600 cfm at 1.5 hp	Poor condition - Face & Bypass damper actuator linkage disconnected; inoperable
RAD-1	HW Finned Tube Radiation	HW finned tube radiation units provide heating along the perimeter of the dining hall area	Fair condition
CH-1	Reciprocating w/ Air Cooled Cond.	80 Ton chiller serves the SZ AHUs	Fair condition
CWP-1	CW pump	5 hp pump serves CH-1, AHU-1, and AHU-2	Fair condition
BLR-1	Steam Boiler	Steam boiler serves SZ AHUs, MAUs, CV-1, and kitchen equipment (6,900,000 Btuh output)	Fair condition
CV-1	STM/HW Converter	STM/HW converter provides HW to RAD-1	Fair condition
HWP-1	HW pump	1/2 hp pump serves RAD-1	Fair condition

4.42.2 HVAC System Components for Repair

The HVAC system components were observed to be in poor to fair condition. The HVAC system components in need of immediate repair are listed in the following table, with the repair costs.

HVAC System No.	HVAC System Type	Description of HVAC System Component for Repair	Repair Cost ($)
AHU-1	SZ	2" CW control valve actuator inoperable - replace entire valve	426
AHU-2	SZ	OA damper actuator linkage is disconnected; damper actuator is inoperable - replace entire assembly	223
MAU-2	MAU	Face & Bypass damper actuator linkage is disconnected; damper actuator is inoperable - replace entire assembly	223
		Total Repair Cost	872

4.42.3 Proposed HVAC System Replacement

The SZ AHUs and the MAUs serving Building 7654 were considered for replacement. The SZ AHUs will be replaced with VAV AHU systems each serving half of the dining area. The MAUs will be replaced with Heat Recovery Unit (HRU) systems each serving half of the kitchen area. The following equipment and materials are included in the proposed HVAC systems replacement:

- VAV AHUs with VSDs will replace the SZ AHUs.
- VAV terminal units with reheat coils will be installed on the zone supply air ducts.
- Thermostats will be installed in each zone; the thermostats will reset the VAV terminal unit controllers that vary the supply air to the zones.
- HRUs will replace MAU-1 and MAU-2.
- Exhaust fans interlocked with MAU-1 and MAU-2 will be removed. Exhaust ductwork will be modified, added, and connected to the exhaust fan outlets and inlets on the HRUs.

Method of Analysis

The EZDOE computer model for the proposed HVAC system replacements in Building 7245 was used to calculate energy savings for Building 7654. The proposed HVAC system replacements in Building 7654 are identical to Building 7245.

The analysis proceeded as follows:

- The energy savings for natural gas and electricity were taken from the proposed HVAC system replacements analysis in Building 7245.
- Construction costs were developed for the proposed HVAC system replacements.
- The energy savings and the construction cost were entered into a LCCA worksheet. Additional information entered into the LCCA worksheet included the following:
  - Economic life is 20 years.
  - Annual maintenance costs were calculated using estimated labor hours and materials.
  - Avoided cost of existing system replacement was included as a non-recurring first year cost.

Energy Savings and Economic Analysis

The energy savings and economic analysis for the proposed HVAC system replacement for the SZ AHUs serving the dining area are included in Appendix D. The results of the analysis are presented in the following table.

Replace SZ AHUs in Dining Area with VAV AHUs

Item	HVAC System Replacement Energy Savings and Economics
Annual Electric Energy Savings (MBtu)	287
Annual Electric Demand Savings ($)	381
Annual Natural Gas Savings (MBtu)	(279)
Total Annual Energy Cost Savings	$2,707
Investment Cost	$33,387
Annual Maintenance Cost Savings	$0
Non-recurring Cost Savings	$21,050
Savings-to-Investment Ratio (SIR)	1.74
Simple Payback (yrs)	8.88

The energy savings and economic analysis for the proposed HVAC system replacement for the MAUs serving the kitchen are included in Appendix D. The results of the analysis are presented in the following table.

Replace MAUs with HRUs

Item	HVAC System Replacement Energy Savings and Economics
Annual Electric Energy Savings (MBtu)	103
Annual Electric Demand Savings ($)	332
Annual Natural Gas Savings (MBtu)	3,511
Total Annual Energy Cost Savings	$16,047
Investment Cost	$90,334
Annual Maintenance Cost Savings	$0
Non-recurring Cost Savings	$30,377
Savings-to-Investment Ratio (SIR)	3.49
Simple Payback (yrs)	5.14

4.42.4 Evaluation of Dedicated Boilers for Space Heating and Service Water Heating

Proposed Modification

The steam boiler serving Building 7654 is used for both space heating and service water heating (SWH) loads. The steam boiler, serving the combined loads, operates at a low part load ratio. At the low part load ratio, the boiler has poor operating efficiencies, especially during the summer months when space heating is not required. The advantage of dedicated boilers for each load is that the space heat boiler may be shut off during the summer months, and the SWH boiler will operate with better efficiency if properly sized to the SWH load. Dedicated boilers were considered for replacement of the existing steam boiler.

Analysis

Building 7245, an Enlisted Personnel Dining Facility, was selected for evaluation (Section 4.40.4). This building has a 6,900,000 Btuh output steam boiler which serves both space heating and SWH heating loads. Building 7654 is identical to Building 7245. The energy savings for the proposed boiler replacement in Building 7654 were taken from the evaluation in Building 7245.

Energy Savings and Economic Analysis

The energy savings and economic analysis for the proposed boiler replacement are included in Appendix D calculations for Building 7245. The results of the analysis are presented in the following table.

Replace Large Steam Boiler with Smaller Steam and Hot Water Boilers

Item	HVAC System Replacement Energy Savings and Economics
Annual Electric Energy Savings (MBtu)	(111)
Annual Electric Demand Savings ($)	0
Annual Natural Gas Savings (MBtu)	1,528
Total Annual Energy Cost Savings	$4,957
Investment Cost	$89,312
Annual Maintenance Cost Savings	($181)
Non-recurring Cost Savings	$101,942
Savings-to-Investment Ratio (SIR)	2.01
Simple Payback (yrs)	9.05

4.42.5 Recommendations

The proposed HVAC system replacements and the proposed boiler replacement are recommended.

4.43 BUILDING 7804 (ENLISTED PERSONNEL DINING)

4.43.1 HVAC System Existing Conditions

Building 7804 is a 13,500 sq.ft., one-story building. The building was built during the late 1950s and is constructed of face brick and concrete block. It is has a dining hall area and a kitchen area. The mechanical equipment room is located in a mezzanine above the kitchen area. Two SZ AHUs provide heating and cooling to the dining hall area. Finned tube radiation units at the perimeter of the dining hall area provide additional heating. Two MAUs provide heating to the kitchen area and make-up air for the kitchen exhaust hoods.

The following table describes the HVAC equipment serving Building 7804.

HVAC System No.	HVAC System Type	Description of HVAC System	Existing Condition
AHU-1	SZ	SZ AHU provides heating and cooling to half of the dining hall area; 7,000 cfm at 5 hp	Poor condition
AHU-2	SZ	SZ AHU provides heating and cooling to the other half of the dining hall area; 7,250 cfm at 5 hp	Poor condition
MAU-1	MAU	MAU-1 provides heating and make-up air to the kitchen area; 11,400 cfm at 5 hp	Poor condition
MAU-2	MAU	MAU-2 provides heating and make-up air to the kitchen area; 3,600 cfm at 1.5 hp	Poor condition - Face & Bypass damper actuator linkage disconnected; inoperable
RAD-1	HW Finned Tube Radiation	HW finned tube radiation units provide heating along the perimeter of the dining hall area	Fair condition
CH-1	Reciprocating w/ Air Cooled Cond.	80 Ton chiller serves the SZ AHUs	Fair condition
CWP-1	CW pump	5 hp pump serves CH-1, AHU-1, and AHU-2	Fair condition
BLR-1	Steam Boiler	Steam boiler serves SZ AHUs, MAUs, CV-1, and kitchen equipment (6,900,000 Btuh output)	Fair condition
CV-1	STM/HW Converter	STM/HW converter provides HW to RAD-1	Fair condition
HWP-1	HW pump	1/2 hp pump serves RAD-1	Fair condition

4.43.2 HVAC System Components for Repair

The HVAC system components were observed to be in poor to fair condition. The HVAC system component in need of immediate repair is listed in the following table, with the repair cost.

HVAC System No.	HVAC System Type	Description of HVAC System Component for Repair	Repair Cost ($)
MAU-2	MAU	Face & Bypass damper actuator linkage is disconnected; damper actuator is inoperable - replace entire assembly	223

4.43.3 Proposed HVAC System Replacement

The SZ AHUs and the MAUs serving Building 7804 were considered for replacement. The SZ AHUs will be replaced with VAV AHU systems each serving half of the dining area. The MAUs will be replaced with Heat Recovery Unit (HRU) systems each serving half of the kitchen area. The following equipment and materials are included in the proposed HVAC systems replacement:

- VAV AHUs with VSDs will replace the SZ AHUs.
- VAV terminal units with reheat coils will be installed on the zone supply air ducts.
- Thermostats will be installed in each zone; the thermostats will reset the VAV terminal unit controllers that vary the supply air to the zones.
- HRUs will replace MAU-1 and MAU-2.
- Exhaust fans interlocked with MAU-1 and MAU-2 will be removed. Exhaust ductwork will be modified, added to, and connected to the exhaust fan outlets and inlets on the HRUs.

Method of Analysis

The EZDOE computer model for the proposed HVAC system replacements in Building 7245 was used to calculate energy savings for Building 7804. The proposed HVAC system replacements in Building 7804 are identical to Building 7245.

The analysis proceeded as follows:

- The energy savings for natural gas and electricity were taken from the proposed HVAC system replacements analysis in Building 7245.

- Construction costs were developed for the proposed HVAC system replacements.

- The energy savings and the construction cost were entered into a LCCA worksheet. Additional information entered into the LCCA worksheet included the following:

  - Economic life is 20 years.

  - Avoided cost of existing system replacement was included as a non-recurring first year cost.

Energy Savings and Economic Analysis

The energy savings and economic analysis for the proposed HVAC system replacement for the SZ AHUs serving the dining area are included in Appendix D. The results of the analysis are presented in the following table.

Replace SZ AHUs in Dining Area with VAV AHUs

Item	HVAC System Replacement Energy Savings and Economics
Annual Electric Energy Savings (MBtu)	287
Annual Electric Demand Savings ($)	381
Annual Natural Gas Savings (MBtu)	(279)
Total Annual Energy Cost Savings	$2,707
Investment Cost	$33,387
Annual Maintenance Cost Savings	$0
Non-recurring Cost Savings	$21,050
Savings-to-Investment Ratio (SIR)	1.74
Simple Payback (yrs)	8.88

The energy savings and economic analysis for the proposed HVAC system replacement for the MAUs serving the kitchen are included in Appendix D. The results of the analysis are presented in the following table.

Replace MAUs with HRUs

Item	HVAC System Replacement Energy Savings and Economics
Annual Electric Energy Savings (MBtu)	103
Annual Electric Demand Savings ($)	332
Annual Natural Gas Savings (MBtu)	3,511
Total Annual Energy Cost Savings	$16,047
Investment Cost	$90,334
Annual Maintenance Cost Savings	$0
Non-recurring Cost Savings	$30,377
Savings-to-Investment Ratio (SIR)	3.49
Simple Payback (yrs)	5.14

4.43.4 Evaluation of Dedicated Boilers for Space Heating and Service Water Heating

Proposed Modification

The steam boiler serving Building 7804 is used for both space heating and service water heating (SWH) loads. The steam boiler, serving the combined loads, operates at a low part load ratio. At the low part load ratio, the boiler has poor operating efficiencies, especially during the summer months when space heating is not required. The advantage of dedicated boilers for each load is that the space heat boiler may be shut off during the summer months, and the SWH boiler will operate with better efficiency if properly sized to the SWH load. Dedicated boilers were considered for replacement of the existing steam boiler.

Analysis

Building 7804, an Enlisted Personnel Dining Facility, was selected for evaluation (Section 4.40.4). This building has a 6,900,000 Btuh output steam boiler which serves both space heating and SWH heating loads. Building 7804 is identical to Building 7245. The energy savings for the proposed boiler replacement in Building 7804 were taken from the evaluation in Building 7245.

Energy Savings and Economic Analysis

The energy savings and economic analysis for the proposed boiler replacement are included in Appendix D calculations for Building 7245. The results of the analysis are presented in the following table.

Replace Large Steam Boiler with Smaller Steam and Hot Water Boilers

Item	HVAC System Replacement Energy Savings and Economics
Annual Electric Energy Savings (MBtu)	(111)
Annual Electric Demand Savings ($)	0
Annual Natural Gas Savings (MBtu)	1,528
Total Annual Energy Cost Savings	$4,957
Investment Cost	$78,207
Annual Maintenance Cost Savings	($181)
Non-recurring Cost Savings	$101,942
Savings-to-Investment Ratio (SIR)	2.29
Simple Payback (yrs)	7.92

4.43.5 Recommendations

The proposed HVAC system replacements and the proposed boiler replacement are recommended.

4.44 BUILDING 7856 (ENLISTED PERSONNEL DINING)

4.44.1 HVAC System Existing Conditions

Building 7856 is a 13,500 sq.ft., one-story building. The building was built during the late 1950s and is constructed of face brick and concrete block. It is has a dining hall area and a kitchen area. The mechanical equipment room is located in a mezzanine above the kitchen area. Two SZ AHUs provide heating and cooling to the dining hall area. Finned tube radiation units at the perimeter of the dining hall area provide additional heating. Two MAUs provide heating to the kitchen area and make-up air for the kitchen exhaust hoods.

The following table describes the HVAC equipment serving Building 7856.

HVAC System No.	HVAC System Type	Description of HVAC System	Existing Condition
AHU-1	SZ	SZ AHU provides heating and cooling to half of the dining hall area; 7,000 cfm at 3 hp	Poor condition - 3 hp supply fan motor bearings are noisy
AHU-2	SZ	SZ AHU provides heating and cooling to the other half of the dining hall area; 7,250 cfm at 5 hp	Poor condition
MAU-1	MAU	MAU-1 provides heating and make-up air to the kitchen area; 11,400 cfm at 5 hp	Poor condition
MAU-2	MAU	MAU-2 provides heating and make-up air to the kitchen area; 3,600 cfm at 1.5 hp	Poor condition - MAU has been disabled; motor is missing; large holes have been cut in OA duct and coil section to take in air from mezzanine area
RAD-1	HW Finned Tube Radiation	HW finned tube radiation units provide heating along the perimeter of the dining hall area	Fair condition
CH-1	Reciprocating w/ Air Cooled Cond.	70 Ton chiller serves the SZ AHUs	Fair condition
CWP-1	CW pump	5 hp pump serves CH-1, AHU-1, and AHU-2	Fair condition
BLR-1	Steam Boiler	Steam boiler serves SZ AHUs, MAUs, CV-1, and kitchen equipment (6,500,000 Btuh output)	Fair condition
CV-1	STM/HW Converter	STM/HW converter provides HW to RAD-1	Fair condition
HWP-1	HW pump	3/4 hp pump serves RAD-1	Fair condition

4.44.2 HVAC System Components for Repair

The HVAC system components were observed to be in poor to fair condition. The HVAC system component in need of immediate repair is listed in the following table, with the estimated cost for repair.

HVAC System No.	HVAC System Type	Description of HVAC System Component for Repair	Repair Cost ($)
AHU-1	SZ	5 hp fan motor bearings are noisy; replace entire motor	276
MAU-2	MAU	1.5 hp fan motor is missing and requires installation; also OA ductwork and MAU coil casing requires patching	288
		Total Repair Cost	564

4.44.3 Proposed HVAC System Replacement

The SZ AHUs and the MAUs serving Building 7856 were considered for replacement. The SZ AHUs will be replaced with VAV AHU systems each serving half of the dining area. The MAUs will be replaced with Heat Recovery Unit (HRU) systems each serving half of the kitchen area. The following equipment and materials are included in the proposed HVAC systems replacement:

- VAV AHUs with VSDs will replace the SZ AHUs.
- VAV terminal units with reheat coils will be installed on the zone supply air ducts.
- Thermostats will be installed in each zone; the thermostats will reset the VAV terminal unit controllers that vary the supply air to the zones.
- HRUs will replace MAU-1 and MAU-2.
- Exhaust fans interlocked with MAU-1 and MAU-2 will be removed. Exhaust ductwork will be modified, added to, and connected to the exhaust fan outlets and inlets on the HRUs.

Method of Analysis

The EZDOE computer model for the proposed HVAC system replacements in Building 7245 was used to calculate energy savings for Building 7856. The proposed HVAC system replacements in Building 7856 are identical to Building 7245.

The analysis proceeded as follows:

- The energy savings for natural gas and electricity were taken from the proposed HVAC system replacements analysis in Building 7245.
- Construction costs were developed for the proposed HVAC system replacements.
- The energy savings and the construction cost were entered into a LCCA worksheet. Additional information entered into the LCCA worksheet included the following:
  - Economic life is 20 years.
  - Avoided cost of existing system replacement was included as a non-recurring first year cost.

Energy Savings and Economic Analysis

The energy savings and economic analysis for the proposed HVAC system replacement for the SZ AHUs serving the dining area are included in Appendix D. The results of the analysis are presented in the following table.

Replace SZ AHUs in Dining Area with VAV AHUs

Item	HVAC System Replacement Energy Savings and Economics
Annual Electric Energy Savings (MBtu)	287
Annual Electric Demand Savings ($)	381
Annual Natural Gas Savings (MBtu)	(279)
Total Annual Energy Cost Savings	$2,707
Investment Cost	$33,387
Annual Maintenance Cost Savings	$0
Non-recurring Cost Savings	$21,050
Savings-to-Investment Ratio (SIR)	1.74
Simple Payback (yrs)	8.88

The energy savings and economic analysis for the proposed HVAC system replacement for the MAUs serving the kitchen are included in Appendix D. The results of the analysis are presented in the following table.

Replace MAUs with HRUs

Item	HVAC System Replacement Energy Savings and Economics
Annual Electric Energy Savings (MBtu)	103
Annual Electric Demand Savings ($)	332
Annual Natural Gas Savings (MBtu)	3,511
Total Annual Energy Cost Savings	$16,047
Investment Cost	$90,334
Annual Maintenance Cost Savings	$0
Non-recurring Cost Savings	$30,377
Savings-to-Investment Ratio (SIR)	3.49
Simple Payback (yrs)	5.14

4.44.4 Evaluation of Dedicated Boilers for Space Heating and Service Water Heating

Proposed Modification

The steam boiler serving Building 7856 is used for both space heating and service water heating (SWH) loads. The steam boiler, serving the combined loads, operates at a low part load ratio. At the low part load ratio, the boiler has poor operating efficiencies, especially during the summer months when space heating is not required. The advantage of dedicated boilers for each load is that the space heat boiler may be shut off during the summer months, and the SWH boiler will operate with better efficiency if properly sized to the SWH load. Dedicated boilers were considered for replacement of the existing steam boiler.

Analysis

Building 7245, an Enlisted Personnel Dining Facility, was selected for evaluation (Section 4.40.4). This building has a 6,900,000 Btuh output steam boiler which serves both space heating and SWH heating loads. Building 7856 is similar to Building 7245. The energy savings for the boiler replacement in Building 7856 were taken from the evaluation in Building 7245.

Energy Savings and Economic Analysis

The energy savings and economic analysis for the proposed boiler replacement are included in Appendix D calculations for Building 7245. The results of the analysis are presented in the following table.

Replace Large Steam Boiler with Smaller Steam and Hot Water Boilers

Item	HVAC System Replacement Energy Savings and Economics
Annual Electric Energy Savings (MBtu)	(111)
Annual Electric Demand Savings ($)	0
Annual Natural Gas Savings (MBtu)	1,528
Total Annual Energy Cost Savings	$4,957
Investment Cost	$78,207
Annual Maintenance Cost Savings	($181)
Non-recurring Cost Savings	$101,942
Savings-to-Investment Ratio (SIR)	2.29
Simple Payback (yrs)	7.92

4.44.5 Recommendations

The proposed HVAC system replacements and the proposed boiler replacement are recommended.

4.45 BUILDING 723 (MAINTENANCE HANGER COMB)

4.45.1 HVAC System Existing Conditions

Building 723 is a 21,640 sq.ft., two-story building. It was built during the mid-1950's and has a metal frame construction with walls consisting of insulated metal panels and concrete block. The building has administrative offices and shops on the first and second floors along the northwest and southeast walls. The maintenance bay is located in the center of the building between the administrative offices and shops. The administrative offices and shops are heated by finned tube radiation and are cooled by window AC units. The maintenance bay is heated by a HW radiant floor system. Floor mounted unit heaters, near the maintenance bay doors, provide heating for heating infiltration air when the doors are open.

The following table describes the HVAC equipment, serving Building 723.

HVAC System No.	HVAC System Type	Description of HVAC System	Existing Condition
UH-1 thru UH-4	STM Floor-Mounted Unit Heaters (Industrial type)	UH-1 through UH-4 serve the maintenance bay; provides heating for infiltration loads from bay door openings	Fair condition
CDP-1 thru CDP-4	Steam condensate pump	1/3 hp condensate pumps - pump condensate from UHs and finned tube radiation units back to steam boiler	Poor condition - all are leaking; each pump is running continuously
RAD-1	HW Tube Floor Radiation	HW tube system in the concrete floor provides radiant heating for the maintenance bay area	Fair condition
RAD-2	STM Finned Tube Radiation	STM finned tube radiation units provide heating in the administration offices and shop areas	Fair condition
BLR-1	Steam Boiler	2,603,000 BTUH (output) Boiler serves UHs, RAD-1, and RAD-2	Fair condition
HWP-1	HW pump	1/2 hp pump serves RAD-1	Fair condition
WAC-1 Thru WAC-4	Window Air-Conditioners	4 WACs provide cooling for the administrative offices and shops (1st & 2nd floors)	Fair condition

4.45.2 HVAC System Components for Repair

The HVAC system components were observed to be in poor to fair condition. The HVAC system components in need of immediate repair are listed in the following table, with the repair costs.

HVAC System No.	HVAC System Type	Description of HVAC System Component for Repair	Repair Cost ($)
CDP-1 thru CDP-4	Steam condensate pump	Replace seals on condensate receivers and pumps; Repair pumps shut-off controls	1,439

4.45.3 Proposed HVAC System Replacement

The HVAC equipment serving Building 723 were not considered for HVAC system replacement.

4.45.4 Recommendations

The HVAC system components for repair are recommended.

4.46 BUILDING 727 (MAINTENANCE HANGER COMB)

4.46.1 HVAC System Existing Conditions

Building 727 is a 36,170 sq.ft., two-story building. The original building was built during the mid-1950's and has a metal frame construction with walls consisting of insulated metal panels and concrete block. An addition was built in 1980 to commodate administrative offices and shops. These offices and shops are located on ground level along the full length of the northwest and southeast walls. The maintenance bay (original building) is located in the center of the building between the administrative offices and shops.

The administrative offices are heated and cooled by a SZ AHU. The shops assembly area, testing area, and breakroom are heated and cooled by a MZ AHU. The remainder of the shops areas are heated by UHs. The maintenance bay is heated by a HW radiant floor system. Floor- mounted unit heaters, near the maintenance bay doors, provide heating for infiltration air when the doors are open.

The following table describes the HVAC equipment, serving Building 727.

HVAC System No.	HVAC System Type	Description of HVAC System	Existing Condition
AHU-1	SZ	SZ AHU provides heating and cooling to the administration offices on the northwest side of the building	Fair condition
AHU-2	MZ	MZ AHU provides heating and cooling to the shops assembly area, testing area, and breakroom on the southeast side of the building	Fair condition - OA/RA damper actuator is inoperable; damper linkage is wired so RA is open and OA is closed
ACCU-1	Air Cooled Condensing Unit	25 Ton ACCU serves the MZ AHU with DX coil	Fair condition
ACCU-2	Air Cooled Condensing Unit	12 Ton ACCU serves the SZ AHU with DX coil	Fair condition
UH-1 thru UH-4	STM Floor-Mounted Unit Heaters (Industrial type)	UH-1 through UH-4 serve the maintenance bay; provides heating for infiltration loads from bay door openings	Fair condition
CDP-1 thru CDP-4	Steam condensate pump	1/3 hp condensate pumps - pump condensate from UHs and finned tube radiation units back to steam boiler	Poor condition - all are leaking; one motor missing; one with noisy bearings
CV-1	Steam/HW converter	Steam/HW converter serves RAD-1	Fair condition
RAD-1	HW Tube Floor Radiation	HW tube system in the concrete floor provides radiant heating for the maintenance bay area	Fair condition
HWP-1 and HWP-2	HW pump	1-1/2 hp pumps serve RAD-1; one pump is standby	Fair condition

HVAC System No.	HVAC System Type	Description of HVAC System	Existing Condition
RAD-2	STM Finned Tube Radiation	STM finned tube radiation units provide heating in the latrines (northwest addition)	Fair condition
BLR-1	Steam Boiler	3,350,000 BTUH (output) STM Boiler serves SZ AHU, UHs, CV-1, and RAD-2	Fair condition
UH-1 thru UH-3	STM Unit Heaters	UH-1 thru UH-3 provide heat to storage area and battery room (northwest addition)	Fair condition
BLR-2	HW Boiler	360,000 BTUH (output) HW Boiler serves MZ AHU, UHs, and finned tube radiation in the southeast addition	Fair condition
UH-1 thru UH-9	HW Unit Heaters	UH-1 thru UH-9 provide heat to the shops and paint booth (southeast addition)	Fair condition
RAD-3	HW Finned Tube Radiation	HW finned tube radiation units provide heating in the latrines and storage area (southeast addition)	Fair condition
HWP-1	HW pump	3 hp pump serves MZ AHU, UHs, and RAD-3	Fair condition

4.46.2 HVAC System Components for Repair

The HVAC system components were observed to be poor to fair condition. The HVAC system components in need of immediate repair are listed in the following table, with the repair costs.

HVAC System No.	HVAC System Type	Description of HVAC System Component for Repair	Repair Cost ($)
AHU-2	MZ	Replace OA/RA pneumatic damper actuator; repair linkage	222
CDP-1 thru CDP-4	Steam condensate pump	Replace seals on condensate receivers and pumps; Repair pumps shut-off controls	1,440
CDP-2	Steam condensate pump	Replace 1/3 hp pump motor	273
		Total Repair Cost	1,935

4.46.3 Proposed HVAC System Replacement

The HVAC equipment serving Building 727 were not considered for HVAC system replacement.

4.46.4 Recommendations

The HVAC system components for repair are recommended.

4.47 BUILDING 741 (MAINTENANCE HANGER COMB)

4.47.1 HVAC System Existing Conditions

Building 741 is a 38,900 sq.ft., two-story building. It was built during the mid-1950's and has a metal frame construction with concrete block walls. The building has administrative offices and shops on the first floor east and west walls. The center area of the building has first floor supply rooms and toilets, and second floor administration offices. Two maintenance bays are located on either side of the center area rooms.

The administrative offices and shops are heated by steam finned tube radiation and are cooled by window AC units. The maintenance bays are heated by four floor mounted fan coil units.

The following table describes the HVAC equipment, serving Building 741.

HVAC System No.	HVAC System Type	Description of HVAC System	Existing Condition
UH-1 thru UH-4	Steam Floor-Mounted Unit Heaters (Industrial type)	UH-1 through UH-4 provide heating for the maintenance bays; fans are 5 hp at 14,200 cfm each; heating coils are 980,000 Btuh each	Poor condition -heating coils are leaky
UH-5 thru UH-8	Steam Unit Heaters	UH-5 through UH-8 provide heating for the administration offices and shop areas	Fair condition
RAD-1	Steam Finned Tube Radiation	Steam finned tube radiation units provide heating in the administration offices and shop areas	Fair condition
BLR-1	Steam Boiler	5,657,000 Btuh (output) Boiler serves UHs and RAD-1; steam condensate is gravity return	Fair condition
WAC-1 Thru WAC-8	Window Air-Conditioners	8 WACs provide cooling for the administrative offices and shops (1st & 2nd floors)	Fair condition

4.47.2 HVAC System Components for Repair

The HVAC system components were observed to be in fair condition, except for the heating coils in UH-1 through UH-4. The HVAC system components in need of immediate repair are listed in the following table with the repair costs.

HVAC System No.	HVAC System Type	Description of HVAC System Component for Repair	Repair Cost ($)
UH-1 thru UH4	Steam floor - mounted unit heaters (industrial type)	Replace 4 steam heating coils, 980,000 Btuh each	4,975

4.47.3 Proposed HVAC System Replacement

The unit heaters and finned tube radiation units serving Building 741 were considered for replacement. UH-1 through UH-4 will be replaced with a gas-fired IR tube heating system. UH-5 through UH-8 and the finned tube radiation units will be replaced with a gas-fired residential furnaces.

Method of Analysis

The approach used for calculating energy savings included using a computer program to simulate a typical building. The EZDOE computer model analysis for Building 7176 (Vehicle Maintenance Shop) was used to evaluate energy savings for the proposed HVAC system replacement in Building 741. The computer model building is similar in use to Building 741.

The analysis proceeded as follows:

- The baseline computer model for Building 7176 was used.
- The ECO model for Building 7176 was used.
- The ECO model energy use was subtracted from the baseline energy use to find the energy savings for natural gas and electricity. The energy savings were prorated on a square foot basis to Building 741.
- A construction cost was developed for the proposed HVAC system replacement.
- The energy savings and the construction cost were entered into a LCCA worksheet. Additional information entered into the LCCA worksheet included the following:
  - Economic life is 20 years.
  - Annual maintenance costs were calculated using estimated labor hours and materials.
  - Avoided cost of existing system replacement was included as a non-recurring fifth year cost.

Energy Savings and Economic Analysis

The energy savings and economic analysis for the proposed HVAC system replacements are included in Appendix D. The results of the analysis are presented in the following table.

Item	HVAC System Replacement Energy Savings and Economics
Annual Electric Energy Savings (MBtu)	213
Annual Electric Demand Savings ($)	0
Annual Natural Gas Savings (MBtu)	626
Total Annual Energy Cost Savings	$5,161
Investment Cost	$142,228
Annual Maintenance Cost Savings	$600
Non-recurring Cost Savings	$63,690
Savings-to-Investment Ratio (SIR)	1.07
Simple Payback (yrs)	15.90

4.47.4 Recommendations

The HVAC systems are not recommended for repair or replacement.

4.48 BUILDING 820 (TACTICAL EQUIPMENT SHOP)

4.48.1 HVAC System Existing Conditions

Building 820 is a 20,560 sq.ft., two-story building. It was built in 1984 and has a metal frame construction with insulated metal panel walls. Equipment supply rooms (on the first floor), and administrative offices and classrooms (on the second floor) are located at the center of the building. Two maintenance bays are located on either side of the center area of the building.

The second floor administrative offices and classrooms are heated by a combination of HW finned tube radiation and a SZ AHU. They are cooled by the SZ AHU. The first floor equipment supply rooms are heated by a combination of HW finned tube radiation and a H&V Unit. The maintenance bays are heated by UHs (four UHs per bay) and have one MAU per bay for heating makeup air for exhaust fans and infiltration air when the doors are open.

The following table describes the HVAC equipment, serving Building 820.

HVAC System No.	HVAC System Type	Description of HVAC System	Existing Condition
AHU-1	SZ	SZ AHU provides heating and cooling to the second floor offices and classrooms (5 hp fan motor; 4,800 cfm)	Fair condition
H&V-1	H&V Unit	H&V Unit provides heating to the first floor equipment supply rooms (3 hp fan motor; 3,400 cfm)	Fair condition
MAU-1	MAU	MAU-1 provides heated makeup air for exhaust fans and additional heating of infiltration air when doors are open (3 hp fan motor; 3,100 cfm)	Fair condition - pneumatic line to 1-1/2" HW 3-way control valve is disconnected
MAU-2	MAU	MAU-2 provides heated makeup air for exhaust fans and additional heating of infiltration air when doors are open (3 hp fan motor; 3,100 cfm)	Fair condition
UH-1 thru UH-8	HW Unit Heaters	UH-1 through UH-8 serve the maintenance bays; four UHs per bay	Fair condition
RAD-1	HW Finned Tube Radiation	HW finned tube radiation units provide heating in the first and second floor offices, classrooms, and supply rooms	Fair condition
BLR-1	Steam Boiler	2,318,000 BTUH (output) Boiler serves AHU-1, H&V-1, MAUs UHs, and RAD-1	Fair condition

HVAC System No.	HVAC System Type	Description of HVAC System	Existing Condition
HWP-1	HW pump	10 hp pump serves AHU-1, H&V-1, MAUs, UHs, and RAD-1	Poor condition - very noisy; Replace pump motor, seals, and bearings
CH-1	Reciprocating w/ Air Cooled Cond.	10 Ton chiller serves the SZ AHU	Fair condition

4.48.2 HVAC System Components for Repair

The HVAC system components were observed to be generally in fair condition. The HVAC system components in need of immediate repair are listed in the following table, with the repair costs.

HVAC System No.	HVAC System Type	Description of HVAC System Component for Repair	Repair Cost ($)
MAU-1	MAU	Repair 1-1/2" HW control valve and reconnect pneumatic line	599
HWP-1	HW pump	Replace 10 hp HW pump motor; replace pump seals and bearings	1,495
		Total Repair Cost	2,094

4.48.3 Proposed HVAC System Replacement

The HW unit heaters serving the maintenance bays in building 820 were considered for replacement with a gas-fired IR tube heating system. A HW boiler will continue to serve AHU-1, H&V-1, MAU-1, MAU-2, and RAD-1. The HW boiler and HW pump will replaced with smaller, energy efficient models.

Method of Analysis

The approach used for calculating energy savings included using a computer program to simulate a typical building. The EZDOE computer model for Building 8300 (Vehicle Maintenance Shop) was used to evaluate energy savings for the proposed HVAC system replacement in Building 820. The computer model building is similar in use and construction to Building 820. The analysis proceeded as follows:

- The computer model zone for the Building 8300 maintenance bay was modified to include the existing heating system types found in Building 820. These modifications represent the baseline computer model for Building 820.

- The baseline computer model was modified to include the HVAC replacement system - the gas-fired IR heating system. The modified baseline is the ECO model. The ECO model included additional modifications as follows:

- Thermostat settings were lowered by 4°F. IR heating systems heat in a manner similar to sunlight, which allows an occupant comfort condition at a reduced air temperature.

- Combustion efficiency for heating equipment was adjusted to 90%.

- The ECO model energy use was subtracted from the baseline energy use to find the energy savings for natural gas and electricity. The energy savings were prorated on a sq ft basis to Building 820.

- A construction cost was developed for the proposed HVAC system replacement.

- The energy savings and the construction cost were entered into a LCCA worksheet. Additional information entered into the LCCA worksheet included the following:

  - Economic life is 20 years.

  - Annual maintenance costs were calculated based on estimated labor hours and materials.

  - Non-recurring costs included the fifth year replacement of the existing HW unit heaters and HW boiler.

<u>**Energy Savings and Economic Analysis**</u>

The energy savings and economic analysis for the IR heating system replacement are included in Appendix D. The results of the analysis are presented in the following table.

Item	HVAC System Replacement Energy Savings and Economics
Annual Electric Energy Savings (MBtu)	11
Annual Electric Demand Savings ($)	0
Annual Natural Gas Savings (MBtu)	104
Total Annual Energy Cost Savings	$560
Investment Cost	$37,546
Annual Maintenance Cost Savings	$370
Non-recurring Cost Savings	$43,700
Savings-to-Investment Ratio (SIR)	1.42
Simple Payback (yrs)	12.05

4.48.4 Recommendations

The HVAC system components for repair is recommended.

4.49 BUILDING 1470 (AR VEHICLE MAINTENANCE SHOP)

4.49.1 HVAC System Existing Conditions

Building 1470 is a 21,670 sq.ft., two-story building. The original building was built during the mid-1970s. An addition to the building was built in 1989. Both the original building and the addition have a metal frame construction with insulated metal panel walls. The original building has an office area, supply room and a warehouse. The addition has an office area and a large maintenance bay.

The original building offices and supply room are heated and cooled by a SZ AHU. The original building warehouse is heated by HW UHs. The addition offices are heated and cooled by a SZ AHU. HW finned tube radiation units provide additional heating to the original building and addition offices and supply room. The maintenance bay are heated by HW UHs. The maintenance bay also has a MAU to provide heated makeup air when exhaust fans are operating.

The following table describes the HVAC equipment, serving Building 1470.

HVAC System No.	HVAC System Type	Description of HVAC System	Existing Condition
AHU-1	SZ	SZ AHU provides heating and cooling to the original building offices (1/3 hp fan motor; 2,500 cfm)	Fair condition
AHU-2	SZ	SZ AHU provides heating and cooling to the addition offices (1/3 hp fan motor; 2,000 cfm)	Good condition
MAU-1	MAU	MAU-1 provides heated makeup air for exhaust fans (20 hp fan motor; 22,200 cfm; gas-fired)	Fair condition
UH-1 thru UH-10	HW Unit Heaters	UH-1 through UH-10 serve the maintenance bay	Fair condition
RAD-1	HW Finned Tube Radiation	HW finned tube radiation units provide additional heating throughout the original building and addition offices and supply room	Fair condition
BLR-1	HW Boiler	792,000 BTUH (output) Boiler serves AHU-2, UHs, and RAD-1	Fair condition
BLR-2	HW Boiler	792,000 BTUH (output) Boiler (standby)	Fair condition
HWP-1	HW pump	2 hp pump serves BLR-1, BLR-2, AHU-2, UHs, and RAD-1	Fair condition
HWP-2	HW pump	2 hp pump (standby)	Fair condition
ACCU-1	Air Cooled Condensing Unit	5 Ton ACCU serves AHU-1	Good condition
ACCU-2	Air Cooled Condensing Unit	5 Ton ACCU serves AHU-2	Fair condition

4.49.2 HVAC System Components for Repair

The HVAC system components were observed to be in fair condition. The HVAC system components are not in need of repair.

4.49.3 Proposed HVAC System Replacement

The HVAC systems serving Building 1470 were not considered for replacement. A proposed HVAC system replacement for Building 820, similar to Building 1470, was considered. The system replacement in Building 820 was not economically feasible, and therefore would not be economically feasible in Building 1470.

4.49.4 Recommendations

The HVAC systems are not recommended for repair or replacement.

4.50 BUILDING 7176 (VEHICLE MAINTENANCE SHOP)

4.50.1 HVAC System Existing Conditions

Building 7176 is a 4,880 sq.ft., one-story building. The building was built in 1956 and is constructed of concrete block. The building has a small office area and a large maintenance bay.

The office area and maintenance bay are heated by HW UHs. A small storage area and the latrine are heated by HW finned tube radiation.

The following table describes the HVAC equipment, serving Building 7176.

HVAC System No.	HVAC System Type	Description of HVAC System	Existing Condition
UH-1 thru UH-5	STM Unit Heaters	UH-1 through UH-5 serve the office area and maintenance bay	Fair condition
RAD-1	STM Finned Tube Radiation	Steam finned tube radiation units provide heating in the storage room and latrine	Fair condition
BLR-1	Steam Boiler	1,000,000 BTUH (output) steam boiler serves UHs and RAD-1	Fair condition

4.50.2 HVAC System Components for Repair

The HVAC system components were observed to be in fair condition. The HVAC system components are not in need of repair.

4.50.3 Proposed HVAC System Replacement

The unit heaters, finned tube radiation units, and steam boiler serving Building 7176 were considered to be replaced with a gas-fired IR heating system. The unit heaters will be replaced with a gas-fired IR tube system and the finned tube radiation units will be replaced with gas-fired IR heaters. The steam boiler will be removed.

Method of Analysis

The approach used for calculating energy savings included using a computer program to simulate a typical building. The EZDOE computer model for Building 8300 (Vehicle Maintenance Shop) was used to evaluate energy savings for the proposed HVAC system

replacement in Building 7176. The computer model building is similar in use and construction to Building 7176. The analysis proceeded as follows:

- The computer model zone for the Building 8300 maintenance bay was modified to included the existing heating system types found in Building 7176. These modifications represent the baseline computer model for Building 7176.

- The baseline computer model was modified to include the HVAC replacement system - the gas-fired IR heating system. The modified baseline is the ECO model. The ECO model included additional modifications as follows:

  - Thermostat settings were lowered by 4°F. IR heating systems heat in a manner similar to sunlight, which allows an occupant comfort condition at a reduced air temperature.

  - Combustion efficiency for heating equipment was adjusted to 90%.

- The ECO model energy use was subtracted from the baseline energy use to find the energy savings for natural gas and electricity. The energy savings were prorated on a square foot basis.

- A construction cost was developed for the proposed HVAC system replacement.

- The energy savings and the construction cost were entered into a LCCA worksheet. Additional information entered into the LCCA worksheet included the following:

  - Economic life is 20 years.

  - Annual maintenance costs were calculated using estimated labor hours and materials.

  - Avoided cost of existing system replacement was included as a non-recurring first year cost.

<u>Energy Savings and Economic Analysis</u>

The energy savings and economic analysis for the IR heating system replacements are included in Appendix D. The results of the analysis are presented in the following table.

Item	HVAC System Replacement Energy Savings and Economics
Annual Electric Energy Savings (MBtu)	28
Annual Electric Demand Savings ($)	0
Annual Natural Gas Savings (MBtu)	83
Total Annual Energy Cost Savings	$688
Investment Cost	$27,000
Annual Maintenance Cost Savings	$600
Non-recurring Cost Savings	$24,734
Savings-to-Investment Ratio (SIR)	1.56
Simple Payback (yrs)	10.70

4.50.4 Recommendations

The proposed HVAC system replacement is not recommended.

4.51 BUILDING 7920 (DS VEHICLE MAINTENANCE SHOP)

4.51.1 HVAC System Existing Conditions

Building 7920 is a 124,550 sq.ft., two-story building. The building was built in 1971 and is constructed of concrete block. The layout of the building is like a five-point star, with five maintenance wings connected at the center (the center area being a large equipment supply room). Each wing has a maintenance bay, office area, storage area, and latrines. Two of the maintenance wings are used for general purpose maintenance and have HVAC equipment that are alike. Three of the maintenance wings are Company maintenance wings and have HVAC equipment that are alike.

The following table describes the HVAC equipment, serving Building 7920.

HVAC System No.	HVAC System Type	Description of HVAC System	Existing Condition
AHU-1, AHU-2 and AHU-3	SZ	SZ AHUs provide heating and cooling to the general maintenance wings offices; each has a gas-fired furnace (1-1/2 hp fan motor; 3,700 cfm each)	Fair condition
ACCU-1, ACCU-2, and ACCU-3	Air Cooled Cond.	8 Ton ACCUs serve AHU-1 thru AHU-3	Fair condition
H&V-1 and H&V-2	H&V	H&Vs provide heating to the general maintenance wings storage areas and latrines; each has a gas-fired furnace (3 hp fan motor; 5,000 cfm each)	Fair condition
MAU-1 and MAU-2	MAU	MAUs provide heating of makeup air for the general maintenance wings bays; each has a gas-fired furnace (10 hp fan motor; 20,250 cfm each)	Fair condition
RAD-1 thru RAD-42	Infrared Radiant Heater (gas-fired)	IR heaters serve the general maintenance wing bays.	Fair condition
AHU-4, AHU-5, and AHU-6	SZ	SZ AHUs provide heating and cooling to the Company maintenance wings offices; each has a gas-fired furnace (1-1/2 hp fan motor; 3,700 cfm each)	Fair condition
ACCU-4, ACCU-5, and ACCU-6	Air Cooled Cond.	8 Ton ACCUs serve AHU-4 thru AHU-6	Fair condition
H&V-3, H&V-4, and H&V-5	H&V	H&Vs provide heating to the Company maintenance wings storage areas and latrines; each has a gas-fired furnace (3 hp fan motor; 5,000 cfm each)	Fair condition

HVAC System No.	HVAC System Type	Description of HVAC System	Existing Condition
MAU-3, MAU-4, and MAU-5	MAU	MAUs provide heating of makeup air for the Company maintenance wings bays; each has a gas-fired furnace (10 hp fan motor; 20,250 cfm each)	Fair condition
RAD-43 thru RAD-109	Infrared Radiant Heater (gas-fired)	IR heaters serve the Company maintenance wing bays.	Fair condition
UH-1 thru UH-11	Gas-fired Unit Heaters	UH-1 through UH-11 provide heating for the center area equipment supply room	Fair condition
DH-1 thru DH-8	Gas-fired Door Heaters	DH-1 through DH-8 provide heating for the infiltration air when overhead doors are opened	Fair condition

4.51.2 HVAC System Components for Repair

The HVAC system components were observed to be in fair condition. The HVAC system components are not in need of repair.

4.51.3 Proposed HVAC System Replacement

The HVAC equipment serving Building 7920 were not considered for replacement.

4.51.4 Recommendations

The HVAC systems are not recommended for repair or replacement.

4.52 BUILDING 8390 (TACTICAL EQUIPMENT SHOP)

4.52.1 HVAC System Existing Conditions

Building 8390 is a 24,755 sq.ft., two-story building. It was built in 1984 and has a metal frame construction with insulated metal panel walls. Offices, repair shops, and equipment supply rooms (on the first floor), and administrative offices and classrooms (on the second floor) are located at the center of the building. Two maintenance bays are located on either side of the center area of the building. The second floor administrative offices and classrooms are heated by a combination of HW finned tube radiation and a SZ AHU. They are cooled by the SZ AHU. The first floor offices, shops, and supply rooms are heated by a combination of HW finned tube radiation and a H&V Unit. The maintenance bays are heated by UHs (four UHs per bay) and have one MAU per bay for heating makeup air for exhaust fans and infiltration air when the doors are open.

The following table describes the HVAC equipment, serving Building 8390.

HVAC System No.	HVAC System Type	Description of HVAC System	Existing Condition
AHU-1	SZ	SZ AHU provides heating and cooling to the second floor offices and classrooms (3 hp fan motor; 3,475 cfm)	Fair condition - OA/RA damper actuator missing
H&V-1	H&V Unit	H&V Unit provides heating to the first floor officec, shops, and supply rooms (3 hp fan motor; 3,345 cfm)	Fair condition
MAU-1	MAU	MAU-1 provides heated makeup air for exhaust fans and additional heating of infiltration air when doors are open in north maintenance bay (2 hp fan motor; 4,700 cfm)	Fair condition - 1" pneumatic 3-way control valve leaking
MAU-2	MAU	MAU-2 provides heated makeup air for exhaust fans and additional heating of infiltration air when doors are open in south maintenance bay (2 hp fan motor; 4,700 cfm)	Fair condition - 1" pneumatic 3-way control valve is leaking
UH-1 thru UH-8	HW Unit Heaters	UH-1 through UH-8 serve the maintenance bays; four UHs per bay	Fair condition
RAD-1	HW Finned Tube Radiation	HW finned tube radiation units provide heating in the first and second floor offices, classrooms, shops, and supply rooms	Fair condition - zone control valves are leaky (approx. 8 control valves)
BLR-1	Steam Boiler	2,600,000 BTUH (output) Boiler serves AHU-1, H&V-1, MAUs, UHs, and RAD-1	Fair condition

HVAC System No.	HVAC System Type	Description of HVAC System	Existing Condition
HWP-1	HW pump	15 hp pump serves AHU-1, H&V-1, MAUs, UHs, and RAD-1	Fair condition
ACCU-1	Air Cooled Cond.	8 Ton chiller serves the SZ AHU	Fair condition

4.52.2 HVAC System Components for Repair

The HVAC system components were observed to be generally in fair condition. The HVAC system components in need of immediate repair are listed in the following table, with the repair costs.

HVAC System No.	HVAC System Type	Description of HVAC System Component for Repair	Repair Cost ($)
AHU-2	SZ	Replace OA/RA pneumatic damper actuator; repair linkage	223
MAU-1	MAU	Replace 1" pneumatic 3-way control valve	206
MAU-2	MAU	Replace 1" pneumatic 3-way control valve	206
RAD-1	HW Finned Tube Radiation	Replace 8 - 3/4" pneumatic 3-way control valves	1,340
		Total Repair Cost	1,975

4.52.3 Proposed HVAC System Replacement

A proposed HVAC system replacement, similar to Building 820, was considered. The system replacement in Building 820 was not economically feasible, and therefore would not be economically feasible in Building 8390.

4.52.4 Recommendations

The HVAC system components for repair are recommended.

4.53 BUILDING 202 (PHYSICAL FITNESS CENTER)

4.53.1 HVAC System Existing Conditions

Building 202 is a 51,300 sq.ft., two-story building. It was constructed during the early 1900's and has sandstone block foundations and walls. The building was originally used as an indoor riding arena for horses. In 1948, the building was completely renovated to establish a physical fitness center.

The Physical Fitness Center has a basketball gymnasium at the center of the building, including an office and storage area. The south end of the building has four raquetball courts, with a men's locker room on the first floor, and an office area and exercise room on the second floor. The north end of the building has a weight training room, women's locker room, and a storage area on the first floor; the entire second floor is a roller skating rink.

The basketball gymnasium is heated by two large industrial UHs (one located at either end of the gymnasium). The raquetball courts are heated by a floor-mounted UH (located in a nearby storage room) and an exhaust fan in the attic. The men's locker room, and the second floor office area and exercise room, are heated and ventilated by a H&V Unit (located in the attic.) A floor-mounted industrial type UH provides heat to the weight training room and the women's locker room. A small packaged AHU provides cooling for the weight training room. The roller skating rink is heated and cooled by a SZ AHU located in the attic space above the rink.

The following table describes the HVAC equipment serving Building 202.

HVAC System No.	HVAC System Type	Description of HVAC System	Existing Condition
UH-1 and UH-2	Wall-mounted UH (industrial type)	UHs provide heating to the basketball gymnasium; approx. 8,000 cfm at 3 hp each	Fair condition - very old
UH-3	Floor-mounted UH (industrial type)	UH provides heating to the raquetball courts; approx. 8,000 cfm at 3 hp; exhaust fan removes excess heat in summer; 6,500 cfm at 3 hp	Fair condition
H&V-1	H&V	H&V serves the men's locker room and second floor office and exercise room area; 8,000 cfm at 3 hp	Fair condition - very old
UH-4	Floor-mounted UH (industrial type	UH provides heating to the weight training room and women's locker room; 8,000 cfm at 3 hp	Fair condition - very old
AHU-1	packaged SZ	SZ AHU provides cooling to the weight training room; 3,000 cfm at 1.5 hp	Fair condition

HVAC System No.	HVAC System Type	Description of HVAC System	Existing Condition
AHU-2	SZ	SZ AHU provides heating and cooling to the roller skating rink; 12,500 cfm at 5 hp	Good condition
CT-1	Water Cooling Tower	CT-1 serves AHU-1	Fair condition - some water scale build-up on interior
ACCU-1	Air Cooled Condensing Unit	45 Ton ACCU serves AHU-2 DX coil	Fair condition - condenser coil fins are damaged
WAC-1 Thru WAC-9	Window Air-Conditioners	9 WACs provide cooling for the offices (1st and 2nd floors)	Fair condition
BLR-1	Steam boiler	Steam boiler (4,250,000 Btuh output) serves the UHs, H&V, and AHU-2	Fair condition

4.53.2 HVAC System Components for Repair

The HVAC system components were observed to be in fair condition. The HVAC system component in need of immediate repair is listed in the following table, with the repair cost.

HVAC System No.	HVAC System Type	Description of HVAC System Component for Repair	Repair Cost ($)
ACCU-1	Air Cooled Condensing Unit	Air cooled condenser coil fins have been damaged by vandalism; replace condenser coil and provide protective screen for cover	979

4.53.3 Proposed HVAC System Replacement

UH-1 and UH-2, serving the basketball gymnasium, were considered for replacement with H&V Units. These UHs were installed in 1948, which makes them approximately 47 years old, and are still in fair condition. The following HVAC equipment, materials, and labor will be included in the system replacement:

- Two wall-mounted UHs will be replaced with four ceiling-hung H&V Units.
- OA ductwork will be installed and connected to each H&V Unit.
- Steam will be piped to each H&V Unit from existing steam main piping.
- Electric thermostats will be installed for each H&V Unit.

Method of Analysis

The approach used for calculating energy savings included using a computer program to simulate a typical building. The EZDOE computer model for Building 8069 was used to evaluate energy savings for the proposed HVAC system replacement. Building 8069 is similar to Building 202. The analysis proceeded as follows:

- The computer model for Building 8069 was used as the baseline computer model for Building 202. The baseline model included the following parameters for the H&V Units:
  - Fan efficiency is 65%;
  - Heating thermostat setpoint is 75 F to simulate a condition of poor space temperature control.
- The baseline computer model was modified to include the proposed HVAC system replacement - H&V Units. The modified baseline is the ECO model. The ECO model included additional modifications as follows:
  - Fan efficiency is 75%;
  - Heating thermostat setpoint is 70 F to simulate a condition of effective space temperature control.
- The ECO model energy use was subtracted from the baseline energy use to find the energy savings for natural gas and electricity. Energy savings were prorated on a sq ft basis to Building 202.
- A construction cost was developed for the proposed HVAC system replacement.
- The energy savings and the construction cost were entered into a LCCA worksheet. Additional information entered into the LCCA worksheet included the following:
  - Economic life is 20 years.
  - Avoided cost of existing system replacement was included as a non-recurring first year cost.

Energy Savings and Economic Analysis

The energy savings and economic analysis for the proposed HVAC system replacement are included in Appendix D. The results of the analysis are presented in the following table.

Item	HVAC System Replacement Energy Savings and Economics
Annual Electric Energy Savings (MBtu)	20
Annual Electric Demand Savings ($)	48
Annual Natural Gas Savings (MBtu)	148
Total Annual Energy Cost Savings	$894
Investment Cost	$64,001
Annual Maintenance Cost Savings	$0
Non-recurring Cost Savings	$17,611
Savings-to-Investment Ratio (SIR)	0.48
Simple Payback (yrs)	36.08

4.53.4 Recommendations

The HVAC system component for repair is recommended.

4.54 BUILDING 7485 (BOWLING ALLEY)

4.54.1 HVAC System Existing Conditions

Building 7485 is a 36,970 sq ft, one-story building. The original building (22 bowling lanes) was built in 1966 and an addition (18 bowling lanes) was added in 1987. Both are constructed of face brick and concrete block.

The original building is heated and cooled by a DD AHU. The addition is heated and cooled by a VAV terminal reheat system.

The following table describes the HVAC equipment serving Building 7485.

HVAC System No.	HVAC System Type	Description of HVAC System	Existing Condition
AHU-1	Dual Duct	DD AHU with 19 mixing boxes provides heating and cooling to the approx. 55% of the building (20 hp and 16,000 cfm)	Fair condition
AHU-2	VAV Reheat	VAV Reheat AHU with 12 VAV boxes provides heating and cooling to approx. 45% of the building (10 hp and 10,000 cfm)	Fair condition - VSD controller does not operate
UH-1 and UH-2	HW Unit Heater	UHs provide heating for storage/maintenance area in addition	Fair condition
CH-1	Reciprocating w/ Air Cooled Cond.	60 Ton chiller serves the DD AHU	Fair condition
CH-2	Reciprocating w/ Air Cooled Cond.	28 Ton chiller serves the VAV Reheat AHU	Fair condition
BLR-1	HW Boiler	1,600,000 Btuh (output) HW boiler serves AHU-1 and AHU-2	Fair condition
HWP-1	HW pump	3 hp pump serves AHU-1, AHU-2, and UHs	Fair condition

4.54.2 HVAC System Components for Repair

The HVAC system components were observed to be in fair condition. The HVAC system component in need of immediate repair is listed in the following table, with the repair cost.

HVAC System No.	HVAC System Type	Description of HVAC System Component for Repair	Repair Cost ($)
AHU-2	VAV Reheat	Replace the existing VSD controller with a new 10 hp VSD controller	3,459

4.54.3 Proposed HVAC System Replacement

The DD AHU serving Building 7485 was considered for conversion to be upgraded to a VAV AHU. The following equipment and materials will be included in the proposed HVAC system replacement:

- DD AHU will be converted to a DD VAV AHU; a VSD will be installed.
- Existing ductwork will remain; the existing mixing boxes will be replaced with dual duct VAV terminal units.
- Thermostats will be installed in each zone; the thermostats will reset the VAV terminal unit controllers that vary the supply air to the zone.

Method of Analysis

The EZDOE computer model for Building 7485 was used to evaluate energy savings for the proposed HVAC system replacement.

The analysis proceeded as follows:

- The computer model for Building 7485 was used for the baseline computer model.
- The baseline computer model was modified to include the HVAC replacement system - the dual duct VAV AHU with VSD. The modified baseline is the ECO model. The following system parameters were also included:
  - Supply air volume varies down to only 50%, to avoid DX coil freeze up.
  - Dual duct VAV terminal units vary supply air volume down to 20%.
  - Supply fan utilizes a bypass when VAV terminal units vary supply air volume below 50%.
- The ECO model energy use was subtracted from the baseline energy use to find the energy savings for natural gas and electricity.
- A construction cost was developed for the proposed HVAC system replacement.
  - The energy savings and the construction cost were entered into a LCCA worksheet. The economic life for the LCCA worksheet is 20 years.

Energy Savings and Economic Analysis

The energy savings and economic analysis for the proposed HVAC system replacement are included in Appendix D. The results of the analysis are presented in the following table.

Item	HVAC System Replacement Energy Savings and Economics
Annual Electric Energy Savings (MBtu)	488
Annual Electric Demand Savings ($)	850
Annual Natural Gas Savings (MBtu)	(293)
Total Annual Energy Cost Savings	$5,552
Investment Cost	$15,055
Annual Maintenance Cost Savings	$0
Non-recurring Cost Savings	$0
Savings-to-Investment Ratio (SIR)	5.61
Simple Payback (yrs)	2.71

4.54.4 Recommendations

The HVAC system component for repair and the proposed HVAC system replacement are recommended.

4.55 BUILDING 6914 (MAIN EXCHANGE)

4.55.1 HVAC System Existing Conditions

Building 6914 is a 63,930 sq ft, one-story building. The building was built in 1973 and is constructed of face brick and concrete block. The Main Exchange has a main retail center, administration offices, and a warehouse. Several small services shops are located along the front of the building.

The retail center is heated and cooled by a SZ AHU. The administration office area adjacent to the retail center is heated and cooled by a SZ AHU. The warehouse is heated by a H&V Unit. The south and north services shops are heated and cooled by two MZ AHUs.

The following table describes the HVAC equipment serving Building 6914.

HVAC System No.	HVAC System Type	Description of HVAC System	Existing Condition
AHU-1	SZ	SZ AHU provides heating and cooling to the main retail center (20 hp and 28,100 cfm)	Fair condition
AHU-2	SZ	SZ AHU provides heating and cooling to the admin. offices in the main retail center (2 hp and 3,500 cfm)	Fair condition - pneumatic control valve for cooling coil is disconnected from air supply
AHU-3	H&V	H&V Unit provides heating to the warehouse in the main retail center (5 hp and 7,390 cfm)	Fair condition
AHU-4	MZ	MZ AHU provides heating and cooling to the south services shops (10 hp and 9,620 cfm)	Fair condition - pneumatic control valves for cooling coil, heating coil, and OA/RA dampers are disconnected from air supply
AHU-5	MZ	MZ AHU provides heating and cooling to the north services shops (7-1/2 hp and 6,790 cfm)	Fair condition - pneumatic control valves for cooling coil, heating coil, and OA/RA dampers are disconnected from air supply
CH-1	Reciprocating	127 ton chiller serves AHU-1, AHU-2, AHU-4, and AHU-5	Fair condition
ACCU-1 and ACCU-2	Air Cooled Condenseing Unit	90 tons (each) ACCUs serve CH-1	Fair condition
CH-2	Reciprocating	127 ton chiller serves AHU-1, AHU-2, AHU-4, and AHU-5	Fair condition
ACCU-3 and ACCU-4	Air Cooled Condenseing Unit	90 tons (each) ACCUs serve CH-2	Fair condition
CWP-1 and CWP-2	CW pump	7.5 hp (each) pump serves CH-1, CH-2, AHU-1, AHU-2, AHU-4, and AHU-5	Fair condition

HVAC System No.	HVAC System Type	Description of HVAC System	Existing Condition
BLR-1	HW Boiler	1,600,000 Btuh (output) HW boiler serves AHU-1 and AHU-2	Fair condition
HWP-1 and HWP-2	HW pump	5 hp (each) pump serves AHU-1, AHU-2, AHU-3, AHU-4, and AHU-5	Fair condition

4.55.2 HVAC System Components for Repair

The HVAC system components were observed to be generally in fair condition. The HVAC system components in need of immediate repair are listed in the following table, with the repair costs.

HVAC System No.	HVAC System Type	Description of HVAC System Component for Repair	Repair Cost ($)
AHU-2	SZ	Replace 1-1/2" pneumatic control valve for cooling coil	300
AHU-4	MZ	Replace pneumatic control valves for cooling coil (2") and heating coil (1-1/4"); replace pneumatic actuator on OA/RA dampers	899
AHU-5	MZ	Replace pneumatic control valves for cooling coil (2") and heating coil (1-1/4"); replace pneumatic actuator on OA/RA dampers	899
		Total Repair Cost	2,098

4.55.3 Proposed HVAC System Replacement

The MZ AHUs serving the service shops in Building 6914 were considered for conversion to VAV AHUs. The following equipment and materials will be included in the proposed HVAC system replacement:

- VSDs will be installed on the MZ AHUs.
- Existing ductwork will remain; VAV terminal units with reheat coils will be installed on the zone supply air ducts.
- Thermostats will be installed in each zone; the thermostats will reset the VAV terminal unit controllers that vary the supply air to the zone.

Method of Analysis

The approach used for calculating energy savings included using a computer program to simulate a typical building. The EZDOE computer model for Building 7108 (Battalion Admin. and Classroom) was used to evaluate energy savings for the proposed HVAC system replacement. Building 7108 is similar to this area of Building 6914, in construction and use. Both buildings have similar HVAC systems.

The analysis proceeded as follows:

- The computer model for Building 7108 was used for the baseline computer model.
- The baseline computer model was modified to include the HVAC replacement system - the VAV AHUs with VSDs. The modified baseline is the ECO model.
- The ECO model energy use was subtracted from the baseline energy use to find the energy savings for natural gas and electricity. The energy savings were prorated on a square foot basis to Building 6914.
- A construction cost was developed for the proposed HVAC system replacement.
  - The energy savings and the construction cost were entered into a LCCA worksheet. The economic life for the LCCA worksheet is 20 years.

Energy Savings and Economic Analysis

The energy savings and economic analysis for the proposed HVAC system replacement are included in Appendix D. The results of the analysis are presented in the following table.

Item	HVAC System Replacement Energy Savings and Economics
Annual Electric Energy Savings (MBtu)	145
Annual Electric Demand Savings ($)	(18)
Annual Natural Gas Savings (MBtu)	(4)
Total Annual Energy Cost Savings	$1,722
Investment Cost	$29,431
Annual Maintenance Cost Savings	$0
Non-recurring Cost Savings	$0
Savings-to-Investment Ratio (SIR)	0.93
Simple Payback (yrs)	17.09

4.55.4 Recommendations

The HVAC system components for repair is recommended.

4.56 BUILDING 6940 (INDOOR SWIMMING POOL)

4.56.1 HVAC System Existing Conditions

Building 6940 is a 23,450 sq ft, one-story building. The building was built in 1976 and has metal frame construction with walls consisting of insulated metal panels and concrete block. The building has a swimming pool, men's and women's lockers, and a storage area.

The swimming pool is heated and ventilated by a H&V Unit. The locker rooms and storage area are also heated and ventilated by a H&V Unit.

The following table describes the HVAC equipment serving Building 6940.

HVAC System No.	HVAC System Type	Description of HVAC System	Existing Condition
H&V-1	H&V Unit	H&V-1 provides heating and ventilating for the swimming pool area; (20 hp and 24,800 cfm)	Fair condition
H&V-2	H&V Unit	H&V-2 provides heating and ventilating for the locker rooms and storage area; (5 hp and 7,000 cfm)	Fair condition -pneumatic actuator on OA damper is missing
BLR-1	HW Boiler	2,800,000 Btuh (output) HW boiler serves H&V-1, H&V-2, and swimming pool water heat exchanger	Fair condition
HWP-1	HW pump	2 hp pump serves BLR-1	Fair condition
HWP-2	HW pump	1 hp pump serves H&V-1	Fair condition
HWP-3	HW pump	1 hp pump serves H&V-2	Fair condition

4.56.2 HVAC System Components for Repair

The HVAC system components were observed to be in fair condition. The HVAC system component in need of immediate repair is listed in the following table, with the repair cost.

HVAC System No.	HVAC System Type	Description of HVAC System Component for Repair	Repair Cost ($)
H&V-2	H&V Unit	Replace pneumatic actuator on OA damper	223

4.56.3 Proposed HVAC System Replacement

The H&V Unit serving the swimming pool area in Building 6940 was considered for replacement with a heat recovery unit (HRU). The following equipment and materials are included in the proposed HVAC system replacement:

- HRU with humidity and space temperature controls will replace the H&V Unit.

- Exhaust ductwork will be installed to exhaust air out through the roof.

- Roof outlet will be installed for exhaust air.

- Existing OA ductwork will remain; HRUs will be connected to the OA ductwork.

Method of Analysis

The EZDOE computer model for Building 8069 swimming pool area was used to evaluate the energy savings. The proposed HVAC system replacement for Building 8069 is similar to Building 6940. The analysis proceeded as follows:

- The computer model for the Building 8069 swimming pool area was used for the baseline computer model.

- The baseline computer model was modified to simulate the HRU. The modified baseline is the ECO model.

- The ECO model energy use was subtracted from the baseline energy use to find the energy savings natural gas and electricity. The energy savings from Building 8069 were prorated on a square foot basis to Building 6940.

- A construction cost was developed for the proposed HVAC system replacement.

- The energy savings and the construction cost were entered into a LCCA worksheet. The economic life for the LCCA worksheet is 20 years.

Energy Savings and Economic Analysis

The energy savings and economic analysis for the proposed HVAC system replacement are included in Appendix D. The results of the analysis are presented in the following table.

Item	HVAC System Replacement Energy Savings and Economics
Annual Electric Energy Savings (MBtu)	706
Annual Electric Demand Savings ($)	0
Annual Natural Gas Savings (MBtu)	7,727
Total Annual Energy Cost Savings	$40,381
Investment Cost	$199,226
Annual Maintenance Cost Savings	$0
Non-recurring Cost Savings	$0
Savings-to-Investment Ratio (SIR)	3.61
Simple Payback (yrs)	4.93

4.56.4 Recommendations

The HVAC system component for repair and the proposed HVAC system replacement are recommended.

4.57 BUILDING 8069 (INDOOR SWIMMING POOL AND GYMNASIUM)

4.57.1 HVAC System Existing Conditions

Building 8069 is a 25,620 sq ft, two-story building. The building was built in 1980 and is constructed of face brick and concrete block. The building has a swimming pool, raquetball courts, exercise room, weight training room, locker rooms, and a basketball gymnasium.

The swimming pool is heated and ventilated by four H&V Units, and has an exhaust fan that removes excess humid air. The raquetball courts, exercise room, and weight training room are heated and cooled by two SZ AHUs. The men's and women's locker rooms on the first floor are heated and ventilated by a H&V Unit. The basketball gymnasium is heated and ventilated by four H&V Units.

The following table describes the HVAC equipment serving Building 8069.

HVAC System No.	HVAC System Type	Description of HVAC System	Existing Condition
H&V-1 thru H&V-4	H&V Unit	H&V Units provide heating and ventilating for the basketball gymnasium (6,750 cfm at 3 hp each)	Fair condition
H&V-5 thru H&V-8	H&V Unit	H&V Units provide heating and ventilating for the swimming pool area; (4,500 cfm at 2 hp each)	Fair condition
RAD-1	HW Finned Tube Radiation	HW finned tube radiation units provide heating in the swimming pool area along the exterior glass wall	Fair condition
H&V-9	H&V Unit	H&V Unit provides heating and ventilating for the first floor locker rooms; (8,000 cfm at 5 hp)	Fair condition
EF-1	Exhaust Fan	EF-1 provides exhaust air from the first floor locker rooms; (8,000 cfm at 1-1/2 hp)	Fair condition
AHU-1	SZ	SZ AHU provides heating and cooling for the second floor exercise room; (5,190 cfm at 3 hp)	Fair condition
AHU-2	SZ	SZ AHU provides heating and cooling for the raquetball courts; (2,125 cfm at 1-1/2 hp)	Fair condition
	Chilled Water	Chilled Water is provided by a Central Chiller Plant	
	Steam	Steam is provided by a Central Boiler Plant	

HVAC System No.	HVAC System Type	Description of HVAC System	Existing Condition
CV-1	Steam/HW convertor	CV-1 provides HW for H&V-1 thru H&V-9, AHU-1, AHU-2, and RAD-1	Fair condition
HWP-1	HW pump	7-1/2 hp pump serves CV-1, H&V-1 thru H&V-9, AHU-1, AHU-2, and RAD-1	Fair condition

4.57.2 HVAC System Components for Repair

The HVAC system components were observed to be in fair condition and are not in need of repair.

4.57.3 Proposed Dehumidification Heat Recovery Unit

A pool dehumidification heat recovery unit (DHRU) was evaluated for the proposed HVAC system replacement of the H&V Units serving the swimming pool area.

The DHRU has two modes of operation, when outside air is above 55 F dewpoint and when outside air is below 55 F dewpoint. In other words, the DHRU operates in either cooling mode or heating mode.

During the heating mode, the DHRU heat recovery unit exchanges heat energy from the exhaust air to the incoming fresh air. The result is a warm dry airstream of incoming fresh air. An auxillary heating coil is used as required to supply heated air to the space. The pool water is heated by an auxillary water heater during this mode.

During the cooling mode, the DHRU heat recovery unit precools 50% of a mixture of fresh air and return air, before it goes through a dehumidification coil. This air then goes through the other side of the heat exchanger where its temperature is increased by absorbing heat energy from precooling the air. The other 50% of the air is then mixed with the conditioned air and passes through a reheat coil to increase the air temperature. The reheat coil is part of the refrigeration cycle heat rejection (similar to an air cooled condenser). Warm dry air is then delivered to the pool space. The heat absorbed during the refrigeration cycle is also used to heat the pool water. Any excess heat beyond the reheat coil and the pool water heating requirements is rejected to the outside air by an air cooled condenser.

Method of Analysis

The energy use during the heating and cooling modes were analyzed using the following:

- EZDOE computer model for Building 8069.
- Manufacterer's computer program for sizing and selection.

- Hand calculations.

The analysis proceeded as follows:

- The computer model for the Building 8069 swimming pool area was used for the baseline computer model.

- The baseline computer model was modified to simulate the heat recovery unit of the DHRU used for the pool space heating only. The modified baseline is the ECO model.

- The manufacturer's computer program was used to calculate the energy use associated with dehumidification of the pool space and to calculate the energy associated with pool water heating.

- A hand calculation was done to estimate the baseline energy use for pool water heating.

- The baseline computer model energy use and the baseline energy use for pool water heating were added together to find the total energy use for the existing equipment.

- The ECO model energy use for the heat recovery unit was added to the energy use calculated by the manufacturer's computer program for dehumidification of the pool space and pool water heating. This represents the total energy use of the DHRU.

- The DHRU energy use was subtracted from the baseline energy use to find the energy savings associated with the operation of the DHRU.

- A construction cost was developed for the DHRU system.

- The energy savings and the construction cost were entered into a LCCA worksheet

Energy Savings and Economic Analysis

The LCCA calculation revealed that this option for the proposed HVAC system replacement was not economically feasible, with a simple payback of 24.5 years and an SIR of 0.82. The calculations and backup data for this analysis are presented in Appendix D.

4.57.4 Heat Recovery Unit

The H&V Units serving the swimming pool area were then considered for replacement with heat recovery units (HRUs). The following equipment and materials are included in the proposed HVAC system replacement:

- Two HRUs with humidity and space temperature controls will replace four H&V Units.
- Exhaust ductwork will be installed to exhaust air out through the roof.
- Roof outlet will be installed for exhaust air.
- Existing OA ductwork will remain; HRUs will be connected to the OA ductwork.

Method of Analysis

The EZDOE computer model for Building 8069 swimming pool area was used to evaluate the energy savings. The analysis proceeded as follows:

- The computer model for the Building 8069 swimming pool area was used for the baseline computer model.
- The baseline computer model was modified to simulate the HRU. The modified baseline is the ECO model.
- The ECO model energy use was subtracted from the baseline energy use to find the energy savings for natural gas and electricity.
- A construction cost was developed for the proposed HVAC system replacement.
- The energy savings and the construction cost were entered into a LCCA worksheet. Additional information entered into the LCCA worksheet included the following:
  - Economic life is 20 years.
  - Avoided cost of existing system replacement was included as a non-recurring fifth year cost.

Energy Savings and Economic Analysis

The energy savings and economic analysis for the proposed HVAC system replacement are included in Appendix D. The results of the analysis are presented in the following table.

Item	HVAC System Replacement Energy Savings and Economics
Annual Electric Energy Savings (MBtu)	295
Annual Electric Demand Savings ($)	0
Annual Natural Gas Savings (MBtu)	3,223
Total Annual Energy Cost Savings	$16,840
Investment Cost	$173,802
Annual Maintenance Cost Savings	$0
Non-recurring Cost Savings	$35,706
Savings-to-Investment Ratio (SIR)	1.90
Simple Payback (yrs)	9.33

4.57.5 Recommendations

The proposed HRU is recommended.

4.58 BUILDING 722 (FLIGHT SIMULATOR)

4.58.1 HVAC System Existing Conditions

Building 722 is a 7,000 sq ft, combination one-story and two-story building. The building was built in 1975 and is constructed of concrete block. The one-story (front) part of the building has three administration offices, a classroom, a maintenance shop, latrines, and storage. The two-story (back) part of the building contains the flight simulator room and the mechanical equipment rooms (the HVAC equipment on the mezzanine level and the hydraulic pump room on the ground level).

The one-story (front) part of the building is heated and cooled by a SZ AHU. The two-story flight simulator room is heated and cooled by a SZ AHU. The flight simulators are cooled by a VAV AHU and the flight simulator computers are cooled by a small SZ AHU.

The following table describes the HVAC equipment serving Building 722.

HVAC System No.	HVAC System Type	Description of HVAC System	Existing Condition
AHU-1	VAV	VAV with 4 VAV boxes and fan volume control provides cooling for the flight simulators; 100% RA (20 hp and 15,590 max. cfm, 4,000 min. cfm)	Fair condition
AHU-2	SZ	SZ AHU provides heating and cooling to the flight simulator room; (10 hp and 7,500 cfm)	Fair condition
AHU-3 and RAF-1	SZ	SZ AHU provides heating and cooling to the admin. offices, classroom, maint. shop, and latrines, (5 hp and 4,050 cfm); RAF-1 serves AHU-3 (5 hp and 3,000 cfm)	Fair condition
AHU-4	Air Conditioning Unit	AC Unit provides cooling to flight simulator computer equipment; 6,400 cfm at 3 hp	Fair condition
CH-1	Reciprocating w/ Air Cooled Cond.	60 Ton chiller serves AHU-1, AHU-2, and AHU-3	Fair condition
CWP-1	CW pump	5 hp pump serves AHU-1, AHU-2, AHU-3, and CH-1	Fair condition
CH-2	Reciprocating w/ Air Cooled Cond.	16 Ton chiller serves AHU-4	Fair condition
CWP-2	CW pump	1/2 hp pump serves AHU-4 and CH-2	Fair condition
BLR-1	HW Boiler	480,100 Btuh (output) HW boiler serves AHU-1, AHU-2, and AHU-3	Fair condition
HWP-1	HW pump	3 hp pump serves AHU-1, AHU-2, and UHs	Fair condition

4.58.2 HVAC System Components for Repair

The HVAC system components were observed to be generally in fair condition and are not in need of repair.

4.58.3 Proposed HVAC System Replacement

The HVAC equipment serving Building 722 were not considered for replacement.

4.58.4 Recommendations

The HVAC systems are not recommended for repair or replacement.

4.59 BUILDING 724 (FLIGHT SIMULATOR)

4.59.1 HVAC System Existing Conditions

Building 724 is a 13,190 sq ft, combination one-story and two-story building. The building was built in 1988 and is constructed of face brick and concrete block. The second-story has insulated metal panel walls. The building has administration offices, a classroom, a maintenance shop, breakroom, latrines, storage, and mechanical equipment rooms in the one-story part of the building. The two-story part of the building is located at the center and contains the flight simulator room.

The one-story part of the building is heated and cooled by a MZ AHU. The two-story flight simulator room is heated and cooled by a SZ AHU. The flight simulator computers are cooled by a two AC Units.

The following table describes the HVAC equipment serving Building 724.

HVAC System No.	HVAC System Type	Description of HVAC System	Existing Condition
AHU-1	MZ	MZ AHU provides heating and cooling for the admin. offices, classroom, maint. shop, breakroom, and latrines, (7.5 hp and 6,200 cfm)	Good condition
AHU-2	SZ	SZ AHU provides heating and cooling to the flight simulator room; (7.5 hp and 6,000 cfm)	Good condition
AHU-3 and AHU-4	Air Conditioning Unit	AC Units provide cooling to the flight simulator computer equipment	Good condition
CH-1 and CH-2	Reciprocating w/ Air Cooled Cond.	25 Ton chillers (each) serve AHU-1 and AHU-2	Good condition
CWP-1	CW pump	3 hp pump serves AHU-1, AHU-2, CH-1, and CH-2	Good condition
CH-3 and CH-4	Reciprocating w/ Air Cooled Cond.	35 Ton chillers (each) serve AHU-3 and AHU4	Good condition
CWP-2	CW pump	1 hp pump serves AHU-3, AHU-4, CH-3 and CH-4	Good condition
BLR-1	HW Boiler	360,000 Btuh (output) HW boiler serves AHU-1 and AHU-2	Good condition
HWP-1	HW pump	1/2 hp pump serves AHU-1, AHU-2, and BLR-1	Good condition

4.59.2 HVAC System Components for Repair

The HVAC system components were observed to be in good condition and are not in need of repair.

4.59.3 Proposed HVAC System Replacement

The HVAC equipment serving Building 724 were not considered for replacement.

4.59.4 Recommendations

The HVAC systems are not recommended for repair or replacement.

4.60 BUILDING 7739 (MOVING TARGET SIMULATOR)

4.60.1 HVAC System Existing Conditions

Building 7739 is a 4,075 sq ft, combination one-story and two-story building. The building was built in 1969 and is constructed of concrete block and insulated metal panel walls. The building has an administration office, a classroom, a maintenance shop, a toilet, a storage, and a mechanical equipment room in the one-story part of the building. The two-story part of the building contains the moving target simulator room.

The entire building (except for the toilet) is heated and cooled by a three zone MZ AHU. HW finned tube radiation provides heating in the administration office, toilet, and hallway.

The following table describes the HVAC equipment serving Building 7739.

HVAC System No.	HVAC System Type	Description of HVAC System	Existing Condition
AHU-1	MZ	MZ AHU provides heating and cooling for the entire building, except for the toilet; (5 hp and 7,064 cfm)	Poor condition
RAD-1	HW Finned Tube Radiation	HW finned tube radiation units provide heating in the admin. office, toilet, and hallway	Fair condition
ACCU-1	Air Cooled Condensing Unit	20 Ton chiller serves AHU-1	Fair condition
BLR-1	HW Boiler	308,000 Btuh (output) HW boiler serves AHU-1 and RAD-1	Fair condition - some rust on exterior jacket
HWP-1	HW pump	1/12 hp pump serves AHU-1	Fair condition
HWP-2	HW pump	1/12 hp pump serves RAD-1 and BLR-1	Fair condition

4.60.2 HVAC System Components for Repair

The HVAC system components were observed to be in fair to poor condition. The HVAC system components in need of immediate repair are listed in the following table, with the repair cost.

HVAC System No.	HVAC System Type	Description of HVAC System Component for Repair	Repair Cost ($)
AHU-1	MZ	Replace 3 pneumatic zone damper actuators; replace pneumatic actuator on OA/RA dampers	893

4.60.3 Proposed HVAC System Replacement

The MZ AHU serving Building 7739 was considered for replacement with a VAV AHU. The following equipment and materials are included in the proposed HVAC system replacement:

- VAV AHU with VSD will replace the MZ AHU.
- VAV terminal units with reheat coils will be installed on the zone supply air ducts.
- Thermostats will be installed in each zone; the thermostats will reset the VAV terminal unit controllers that vary the supply air to the zones.
- Existing ductwork will be modified to better serve the moving target simulator zone.

Method of Analysis

The approach used for calculating energy savings included using a computer program to simulate a typical building. The EZDOE computer model for Building 7806 HVAC system replacement was used to evaluate the energy savings. The proposed HVAC system replacement for Building 7806 is similar to Building 7739. The energy savings from Building 7806 were prorated on a square foot basis to Building 7739.

The analysis proceeded as follows:

- A construction cost was developed for the proposed HVAC system replacement.
- The energy savings and the construction cost were entered into a LCCA worksheet. Additional information entered into the LCCA worksheet included the following:
  - Economic life is 20 years.
  - Avoided cost of existing system replacement was included as a non-recurring fifth year cost.

Energy Savings and Economic Analysis

The energy savings and economic analysis for the proposed HVAC system replacement are included in Appendix D. The results of the analysis are presented in the following table.

Item	HVAC System Replacement Energy Savings and Economics
Annual Electric Energy Savings (MBtu)	101
Annual Electric Demand Savings ($)	283
Annual Natural Gas Savings (MBtu)	(37)
Total Annual Energy Cost Savings	$1,359
Investment Cost	$27,484
Annual Maintenance Cost Savings	$0
Non-recurring Cost Savings	$14,830
Savings-to-Investment Ratio (SIR)	1.23
Simple Payback (yrs)	13.09

4.60.4 Recommendations

The HVAC system component for repair is recommended.

4.61 BUILDING 6620 (COMMUNITY ACTIVITIES CENTER)

4.61.1 HVAC System Existing Conditions

Building 6620 is a 31,740 sq ft, two-story building, built in 1962 and is constructed of face brick and concrete block. The building was originally constructed for use as the NonCommissioned Officers Club with Open Mess. It is currently used as the Community Activities Center and has a large ballroom, dining room, kitchen area, and an office area on the west wing.

A seven zone MZ AHU provides heating and cooling to the west wing office area. Additional heating in the west wing office area is provided by HW perimeter radiation units along the building perimeter. The ballroom and dining room are heated and cooled each by SZ AHUs. The kitchen area is heated and ventilated by a H&V Unit.

The following table describes the HVAC equipment serving Building 6620.

HVAC System No.	HVAC System Type	Description of HVAC System	Existing Condition
AHU-1	MZ	MZ AHU provides heating and cooling to the west wing office area (7-1/2 hp and 12,910 cfm)	Fair condition
AHU-2	SZ	SZ AHU provides heating and cooling to the ballroom (7-1/2 hp and 9,600 cfm)	Poor condition - fan bearings noisy
AHU-3	SZ	SZ AHU provides heating and cooling to the dining room (5 hp and 8,800 cfm)	Fair condition
H&V-1	H&V Unit	H&V Unit provides heating and ventilation to the kitchen area (5 hp and 10,500 cfm)	Fair condition
RAD-1	HW finned tube radiation units	Perimeter radiation units provide additional heating in the west wing office area	Fair condition
CH-1	Reciprocating w/ Air Cooled Cond.	120 Ton chiller serves AHU-1, AHU-2, and AHU-3	Fair condition
CWP-1 and CWP-2	CW pump	7-1/2 hp pump (ea.) serves CH-1, AHU-1, AHU-2, and AHU-3; CWP-2 is a standby	Fair condition
BLR-1	Steam boiler	Steam boiler serves the AHUs, H&V Unit, and CV-1	Fair condition
BP-1	Boiler feed pump	1/2 hp pump serves BLR-1	Poor condition - pump seals leaking
BLR-2	Steam boiler	Steam boiler serves the AHUs, H&V Unit, and CV-1 (standby)	Fair condition
BP-2	Boiler feed pump	1/2 hp pump serves BLR-1	Poor condition - pump seals leaking
CV-1	STM/HW Convertor	CV-1 provides HW to RAD-1	Fair condition

HVAC System No.	HVAC System Type	Description of HVAC System	Existing Condition
HWP-1	HW pump	1/2 hp pump serves RAD-1	Fair condition

4.61.2 HVAC System Components for Repair

The HVAC system components were observed to be in poor to fair condition. The HVAC system component in need of immediate repair is listed in the following table, with the estimated costs for repair.

HVAC System No.	HVAC System Type	Description of HVAC System Component for Repair	Repair Cost ($)
AHU-2	SZ	Replace fan bearings -bearings very noisy; Replace 7-1/2 hp fan motor - bearings very noisy	389
BP-1	Boiler feed pump	Replace pump seals - leaking (15 gpm at 46 ft. of head)	208
BP-2	Boiler feed pump	Replace pump seals - leaking (15 gpm at 46 ft. of head)	209
		Total Repair Cost	806

4.61.3 Proposed HVAC System Replacement

The SZ AHUs serving Building 6620 were considered for replacement with VAV AHUs. The following equipment and materials are included in the proposed HVAC system replacement:

- VAV AHUs with VSDs will replace the SZ AHUs.
- VAV terminal units with reheat coils will be installed on the zone supply air ducts; the existing ductwork will remain.
- Thermostats will be installed in each zone; the thermostats will reset the VAV terminal unit controllers that vary the supply air to the zones.

The MZ AHU serving the west wing office area in Building 6620 was considered for conversion to a VAV AHU. The following equipment and materials will be included in the proposed HVAC system replacement:

- VSD controller will be installed on the MZ AHU to control the supply fan speed.
- VAV terminal units will be installed on the zone supply air ducts.

- Pneumatic actuators on the hot and cold deck zone dampers will be retrofitted with electric actuators. A summer-winter changeover control switch will be installed to close the retrofitted zone dampers on the hot and cold decks during heating or cooling seasons. The hot and cold deck dampers will be interconnected so the hot deck damper will close during the cooling season and the cold deck damper will close during the heating season.

- Thermostats will be installed in each zone; the thermostats will reset the VAV terminal unit controllers that vary the supply air to the zones.

Method of Analysis

The approach used for calculating energy savings for the SZ AHU systems replacement included using a computer program to simulate a typical building. The EZDOE computer model for Building 7086 was used to evaluate energy savings. Building 7086 (Unit Chapel) assembly area is similar in use to the ball room and dining room areas of Building 6620.

The analysis proceeded as follows:

- The computer model for Building 7086 was used for the baseline computer model.

- The baseline computer model was modified to include the HVAC replacement systems - the VAV AHUs with VSDs. The VSD controls were set to vary the supply air volume down to 20%. The modified baseline is the ECO model.

- The ECO model energy use was subtracted from the baseline energy use to find the energy savings for natural gas and electricity.

- A construction cost was developed for the proposed HVAC system replacement.

- The energy savings and the construction cost were entered into a LCCA worksheet. Additional information entered into the LCCA worksheet included the following:

  - Economic life is 20 years.

  - Avoided cost of existing system replacement was included as a non-recurring fifth year cost.

The approach used for calculating energy savings for the MZ AHU system conversion included using a computer program to simulate a typical building. The EZDOE computer model for Building 7108 (Battalion Admin. and Classroom) was used to evaluate energy savings. Building 7108 is similar in use to the administration office area in Building 6620.

The analysis proceeded as follows:

- The computer model for Building 7108 was used for the baseline computer model.
- The baseline computer model was modified to include the HVAC replacement system - the MZ AHU converted to a VAV AHU with a VSD. The modified baseline is the ECO model.
- The ECO model energy use was subtracted from the baseline energy use to find the energy savings for natural gas and electricity. Energy savings were prorated on a sq ft basis to Building 6620.
- A construction cost was developed for the proposed HVAC system replacement.
- The energy savings and the construction cost were entered into a LCCA worksheet. The economic life for the LCCA is 20 years.

Energy Savings and Economic Analysis

The energy savings and economic analysis for the proposed HVAC system replacement for the SZ AHUs are included in Appendix D. The results of the analysis are presented in the following table.

Replace SZ AHUs with VAV AHUs

Item	HVAC System Replacement Energy Savings and Economics
Annual Electric Energy Savings (MBtu)	478
Annual Electric Demand Savings ($)	539
Annual Natural Gas Savings (MBtu)	199
Total Annual Energy Cost Savings	$7,138
Investment Cost	$47,075
Annual Maintenance Cost Savings	$0
Non-recurring Cost Savings	$30,326
Savings-to-Investment Ratio (SIR)	2.99
Simple Payback (yrs)	5.44

The energy savings and economic analysis for the proposed HVAC system replacement for the MZ AHU conversion are included in Appendix D. The results of the analysis are presented in the following table.

Convert MZ AHU to VAV AHU

Item	HVAC System Replacement Energy Savings and Economics
Annual Electric Energy Savings (MBtu)	176
Annual Electric Demand Savings ($)	(122)
Annual Natural Gas Savings (MBtu)	(9)
Total Annual Energy Cost Savings	$1,972
Investment Cost	$13,076
Annual Maintenance Cost Savings	$0
Non-recurring Cost Savings	$0
Savings-to-Investment Ratio (SIR)	2.40
Simple Payback (yrs)	6.63

4.61.4 Recommendations

The proposed HVAC system replacements are recommended.

4.62 BUILDING 7604 (GENERAL INSTRUCTION BUILDING)

4.62.1 HVAC System Existing Conditions

Building 7604 is a 13,500 sq ft, one-story building. The building was built during the late 1950s and is constructed of face brick and concrete block. It was originally built for use as a Five Company Mess Hall and was recently converted to a General Instruction Building. The building has four classrooms at the center with administration offices along the perimeter.

The mechanical equipment room is located in a mezzanine above the administration offices. Two MZ AHUs provide heating and cooling to the administration offices and classrooms. A SZ AHU provides heating and cooling to administration offices also.

The following table describes the HVAC equipment serving Building 7604.

HVAC System No.	HVAC System Type	Description of HVAC System	Existing Condition
AHU-1	MZ	MZ AHU provides heating and cooling to the west half of the building; (5 hp and 6,000 cfm)	Good condition
AHU-2	MZ	MZ AHU provides heating and cooling to the east half of the building; (5 hp and 6,000 cfm)	Good condition
AHU-3	SZ	SZ AHU provides heating and cooling to admin. offices on the south perimeter of the building (2 hp and 2,000 cfm)	Good condition
CH-1	Reciprocating w/ Air Cooled Cond.	70 Ton chiller serves AHU-1, AHU-2, and AHU-3	Fair condition
CWP-1	CW pump	2 hp pump serves CH-1, AHU-1, AHU-2, AHU-3	Fair condition
BLR-1	HW Boiler	HW boiler serves AHU-1, AHU-2, and AHU-3 (648,000 Btuh output)	Fair condition
HWP-1	HW pump	2 hp pump serves BLR-1, AHU-1, AHU-2, and AHU-3	Fair condition
HWP-2	HW pump	2 hp pump serves BLR-1, AHU-1, AHU-2, and AHU-3 (standby)	Fair condition

4.62.2 HVAC System Components for Repair

The HVAC system components were observed to be in fair to good condition. The HVAC system components are not in need of repair.

4.62.3 Proposed HVAC System Replacement

The HVAC systems serving Building 7604 were not considered for replacement.

4.62.4 Recommendations

The HVAC systems are not recommended for repair or replacement.

4.63 BUILDING 7656 (GENERAL INSTRUCTION BUILDING)

4.63.1 HVAC System Existing Conditions

Building 7656 is a 13,500 sq ft, one-story building. The building was built during the late 1950s and is constructed of face brick and concrete block. It was originally built for use as a Five Company Mess Hall and was recently converted to a General Instruction Building. The building has four classrooms at the center with administration offices along the perimeter.

The mechanical equipment room is located in a mezzanine above the administration offices. Two MZ AHUs provide heating and cooling to the administration offices and classrooms.

The following table describes the HVAC equipment serving Building 7656.

HVAC System No.	HVAC System Type	Description of HVAC System	Existing Condition
AHU-1	MZ	MZ AHU provides heating and cooling to the west half of the building; (5 hp and 7,000 cfm)	Good condition
AHU-2	MZ	MZ AHU provides heating and cooling to the east half of the building; (5 hp and 7,000 cfm)	Good condition
CH-1	Reciprocating w/ Air Cooled Cond.	70 Ton chiller serves AHU-1, AHU-2, and AHU-3	Fair condition
CWP-1	CW pump	2 hp pump serves CH-1, AHU-1, AHU-2, AHU-3	Fair condition
BLR-1	HW Boiler	HW boiler serves AHU-1, AHU-2, and AHU-3; (estimated at 3,500,000 Btuh output, original Steam boiler at 6,900,000 Btuh output was converted to HW)	Fair condition
HWP-1	HW pump	2 hp pump serves BLR-1, AHU-1, AHU-2, and AHU-3	Fair condition
HWP-2	HW pump	2 hp pump serves BLR-1, AHU-1, AHU-2, and AHU-3 (standby)	Fair condition

4.63.2 HVAC System Components for Repair

The HVAC system components were observed to be in fair to good condition. The HVAC system components are not in need of repair.

4.63.3 Proposed HVAC System Replacement

The HVAC systems serving Building 7656 were not considered for replacement.

4.63.4 Recommendations

The HVAC systems are not recommended for repair or replacement.

5. SUMMARY OF HVAC UPGRADE

5.1 GENERAL

This section summarizes the results of the evaluation performed for the HVAC systems in the 70 buildings included in this feasibility study. A summary of HVAC system components for repair and a summary of proposed HVAC system replacements are provided.

5.2 SUMMARY OF HVAC SYSTEM COMPONENTS FOR REPAIR

HVAC system components in need of repair were found in 40 of the 70 buildings evaluated. The HVAC system components for repair are summarized in Table 5-1 on page 5-2.

5.3 SUMMARY OF PROPOSED HVAC SYSTEM REPLACEMENTS

The proposed HVAC system replacements were analyzed for 39 of the 70 buildings evaluated. The proposed HVAC system replacements are summarized in Table 5-2 on page 5-3.

Some of the 39 buildings evaluated required analysis of more than one HVAC system per building. A total of 51 proposed HVAC system replacements were analyzed.

The economic analysis summary for the proposed HVAC system replacements is presented in Table 5-3 on page 5-5. The proposed HVAC system replacements are ranked by SIR, from highest SIR to lowest SIR. The economic analysis for the proposed HVAC system replacements revealed that 32 of the 51 HVAC systems analyzed qualified for the ECIP funding program (simple paybacks below 10 years and SIRs greater than 1.25).

TABLE 5-1
SUMMARY OF HVAC COMPONENTS FOR REPAIR

TAB	BLDG NO.	BLDG NAME	DESCRIPTION OF HVAC COMPONENTS FOR REPAIR	REPAIR COST ($)
Admin. Buildings 1	222	ADMIN GEN PURP	DAMPER ACTUATOR	223
	302	FINANCE ADMIN	FAN BEARING	91
	313	CIV PERS BLDG	CONDENSER COIL (PLUS COVER)	797
	7636	REGIMENTAL HQ BLDG	CONTROL VALVE 2-1/2"	1,050
	8056	DET DAY ROOM	PUMP, 3/4 HP	744
Admin. & Supply Buildings 2	7602	ADMIN & SUPPORT BLDG	COOLING COIL, 2ROW, 30" x 30", STEEL PIPE SCH. 40, 1.25" W/HANGERS & 1.25" FIBERGLASS PIPE INSULATION, 1.5" THCK	3,914
	7608	ADMIN & SUPPLY BLDG	COOLING COIL, 2ROW, 30" x 30", STEEL PIPE SCH. 40, 1.25" W/HANGERS & 1.25" FIBERGLASS PIPE INSULATION, 1.5" THCK	3,914
	7652	ADMIN & SUPPLY BLDG	COOLING COIL, 2ROW, 30" x 30", STEEL PIPE SCH. 40, 1.25" W/HANGERS & 1.25" FIBERGLASS PIPE INSULATION, 1.5" THCK	3,914
	7658	ADMIN & SUPPLY BLDG	COOLING COIL, 2ROW, 30" x 30", STEEL PIPE SCH. 40, 1.25" W/HANGERS & 1.25" FIBERGLASS PIPE INSULATION, 1.5" THCK	3,914
Barracks Buildings 3	227	ENL BARRACKS W/AS	CONTROL VALVE 1" & CONTROL VALVE 1-1/2"	506
	402	ENL BARRACKS W/AS	CONTROL VALVE 1"	300
	7612	ENL BARRACKS W/AS	PUMP SEAL	208
	7614	ENL BARRACKS W/AS	PUMP SEAL	625
	7810	ENL BARRACKS W/O DIN	PUMP SEAL	417
	7814	ENL BARRACKS W/O DIN	PUMP, 2 HP & PUMP SEAL	1,219
	8002	ENL BARRACKS W/O DIN	CONTROL VALVE 1/2" & 3-SPEED FAN SWITCH	2,227
	8012	ENL BARRACKS W/O DIN	CONTROL VALVE 1/2" & 3-SPEED FAN SWITCH	2,227
	8014	ENL BARRACKS W/O DIN	CONTROL VALVE 1/2" & 3-SPEED FAN SWITCH	1,114
	8038	ENL BARRACKS W/O DIN	CONTROL VALVE 1/2" & 3-SPEED FAN SWITCH	2,227
	8040	ENL BARRACKS W/O DIN	CONTROL VALVE 1/2" & 3-SPEED FAN SWITCH	1,114
	8042	ENL BARRACKS W/O DIN	CONTROL VALVE 1/2" & 3-SPEED FAN SWITCH	2,227
	8048	ENL BARRACKS W/O DIN	CONTROL VALVE 1/2" & 3-SPEED FAN SWITCH	1,114
	8050	ENL BARRACKS W/O DIN	CONTROL VALVE 1/2" & 3-SPEED FAN SWITCH	1,114
	8052	SR ENL QTRS	CONTROL VALVE 1/2" & 3-SPEED FAN SWITCH	2,227
Dining Facilities 7	7245	ENL PERS DIN	CONTROL VALVE 2" & DAMPER ACTUATOR	872
	7606	ENL PERS DIN	CONTROL VALVE 2" & PUMP, 2 HP	1,863
	7654	ENL PERS DIN	CONTROL VALVE 2" & DAMPER ACTUATOR	872
	7804	ENL PERS DIN	DAMPER ACTUATOR	223
	7856	ENL PERS DIN	FAN MOTOR, 1-1/2 HP, FAN MOTOR, 5 HP & PATCH DUCTWORK	564
Maintenance Shops 8	723	MNT HANGAR COMB	PUMP SEAL, CONDENSATE PUMP GASKET & CONDENSATE SHUT-OFF CONTROLS	1,439
	727	MNT HANGAR COMB	DAMPER ACTUATOR, PUMP SEAL, CONDENSATE PUMP GASKET, CONDENSATE SHUT-OFF CONTROLS & PUMP MOTOR, 1/3 HP	1,935
	741	MNT HANGAR COMB	REPLACE FOUR STEAM HEATING COILS, 980,000 BTUH CAPACITY EACH	4,975
	820	TAC EQUIP SHOP	CONTROL VALVE 1-1/2", PUMP MOTOR, 10 HP & PUMP SEAL	2,094
	8390	TAC EQUIP SHOP	DAMPER ACTUATOR, CONTROL VALVE 1" & CONTROL VALVE 3/4"	1,975
Recreation & Retail Facilities 9	202	PHYS FITNESS CTR	CONDENSER COIL (PLUS COVER)	979
	6914	EXC MAIN RETL	CONTROL VALVE 1-1/2", CONTROL VALVE 2", CONTROL VALVE 1-1/4" & DAMPER ACTUATOR	2,098
	6940	INDOOR SWIM POOL	DAMPER ACTUATOR	223
	7485	BOWLING ALLEY	VARIABLE SPEED DRIVE W/ CONTRLER,10HP	3,459
Simulator Building 10	7739	MOVING TARGET SIMULATOR BLDG	DAMPER ACTUATOR	893
Training Building 11	6620	COMMUN ACT CTR	FAN MOTOR, 7-1/2 HP & PUMP SEAL	806

TABLE 5-2
PROPOSED HVAC SYSTEMS FOR REPLACEMENT

TAB	BLDG NO.	BLDG NAME	EXISTING HVAC SYSTEM TYPE	PROPOSED HVAC SYSTEM TYPE
Admin. Buildings 1	222	ADMIN GEN PURP	Win. ACs / P. Rad. / SZ	Replace SZ with VAV AHU
	5000	FIRE STATION	MZ / H&V / Gas IRs	Replace MZ with 3 Furnance AC Units, Replace Boiler with smaller Boiler, and Replace ACCU with 3 smaller ACCUs
	7178	MOTOR POOL ADMIN	Gas-Fired UHs / Win. ACs	Replace 3 Win. ACs with small SZ w/ DX coil
Admin. & Supply Buildings 2	7243	ADMIN & SUPPLY BLDG	Win. AC / P. Rad. / FCs in building addition	Replace 15 Win. ACs with 5 small SZs w/ DX coils
	7602	ADMIN & SUPPLY BLDG	SZ (Clg Only) / P. Rad. (All)	Replace existing SZs with new SZs
	7608	ADMIN & SUPPLY BLDG	SZ (Clg Only) / P. Rad. (All)	Replace existing SZs with new SZs
	7652	ADMIN & SUPPLY BLDG	SZ (Clg Only) / P. Rad. (All)	Replace existing SZs with new SZs
	7658	ADMIN & SUPPLY BLDG	SZ (Clg Only) / P. Rad. (All)	Replace existing SZs with new SZs
Barracks Buildings 3	227	ENL BARRACKS W/AS	MZs	Replace MZs and SZs with VAV AHUs
	402	ENL BARRACKS W/AS	MZs	Replace MZs and SZ with VAV AHUs
	410	ENL BARRACKS W/AS	MZs	Replace MZs with VAV AHUs
	7404	ENL BARRACKS W/O DIN	MZ / P. Rad.	Convert 2 MZs to VAVs
	7612	ENL BARRACKS W/AS	Dual Temp. FCs / SZs	Replace FCs and SZs with VAV AHUs
	7614	ENL BARRACKS W/AS	Dual Temp. FCs / SZs	Replace FCs and SZs with VAV AHUs
	7616	ENL BARRACKS W/AS	Dual Temp. FCs / SZs	Replace FCs and SZs with VAV AHUs
	7810	ENL BARRACKS W/O DIN	Dual Temp. FCs / SZs	Replace FCs and SZs with VAV AHUs
	7814	ENL BARRACKS W/O DIN	Dual Temp. FCs / SZs	Replace FCs and SZs with VAV AHUs
Battalion Buildings 4	7806	BN HQ BLDG	SZs / P. Rad.	Replace SZs with VAV AHUs
	8025	BN ADMIN & CLRM	MZs / P. Rad.	Convert MZs to VAVs
Chapel Buildings 5	3	POST CHAPEL	SZ	Replace SZ, H&V, Stm Boiler and Cooling Tower with VAV AHU, HW Boiler, and Water Chiller
	7086	UNIT CHAPEL	SZ / FCs	Replace SZ with VAV AHU
Dental Clinic Buildings 6	602	DENTAL CLINIC	DD	Convert DD to DD w/ VAV
	7665	DENTAL CLINIC	MZ	Convert MZ to VAV
	7670	DENTAL CLINIC	DD	Convert DD to DD w/ VAV
Dining Facilities 7	7245	ENL PERS DIN	SZs / H&Vs	Replace SZs with VAV AHUs; Replace H&Vs with Heat Recovery Units
	7606	ENL PERS DIN	SZs / H&Vs	Replace SZs with VAV AHUs; Replace H&Vs with Heat Recovery Units
	7654	ENL PERS DIN	SZs / H&Vs	Replace SZs with VAV AHUs; Replace H&Vs with Heat Recovery Units
	7804	ENL PERS DIN	SZs / H&Vs	Replace SZs with VAV AHUs; Replace H&Vs with Heat Recovery Units
	7856	ENL PERS DIN	SZs / H&Vs	Replace SZs with VAV AHUs; Replace H&Vs with Heat Recovery Units
Maintenance Shops 8	741	MNT HANGAR COMB	UHs / P. Rad.	Replace Industrial Type UHs with Gas-fired Infrared Radiant Tube System
	820	TAC EQUIP SHOP	SZ / UHs / P. Rad.	Replace HW UHs with Gas-fired Infrared Radiant Tube System; Down size HW Boiler
	7176	MOTOR POOL MNT SHOP	UHs	Replace UHs and Steam Boiler with IR Tube Heating System
Recreation & Retail Facilities 9	202	PHYS FITNESS CTR	SZ / UHs	Replace two Industrial Type Unit Heaters in Basketball Gym with four H&V Units
	7485	BOWLING ALLEY	DD / VAV	Convert DD to DD w/ VAV
	6914	EXC MAIN RETL	SZs / MZs	Convert two MZs to VAVs
	6940	INDOOR SWIM POOL	H&V / SZ	Replace H&Vs with Heat Recovery Units
	8069	INDOOR SW POOL/GYM	H&Vs / SZ	Replace H&V with Heat Recovery Unit
Simulator Building 10	7739	MOVING TARGET SIMULATOR BLDG	MZ / FCs	Replace MZ with VAV AHU
Training Building 11	6620	COMMUN ACT CTR	SZ / MZ / H&V	Replace 2 SZs with VAV AHUs; Convert MZ to VAV

TABLE 5-3
ECONOMIC SUMMARY FOR PROPOSED HVAC SYSTEM REPLACEMENT

BLDG NO.	BLDG NAME	PROPOSED HVAC SYSTEM TYPE	NAT. GAS ENERGY SAVINGS (MBtu/yr)	ELEC. ENERGY SAVINGS (MBtu/yr)	TOTAL ENERGY SAVINGS (MBtu/yr)	NAT. GAS COST SAVINGS ($/yr)	ELEC. COST SAVINGS ($/yr)	DEMAND kW COST SAVINGS ($/yr)	TOTAL ENERGY COST SAVINGS ($/yr)	ANNUAL MAINT. SAVINGS ($/yr)	NON-RECURRING SAVINGS ($)	TOTAL INVESTMENT ($)	SIMPLE PAYBACK (yrs)	SIR
7485	BOWLING ALLEY	Convert DD to DD w/ VAV	(293)	488	196	($1,205)	$5,907	$850	$5,552	$0	$0	$15,055	2.71	5.61
7665	DENTAL CLINIC	Convert MZ to VAV	(107)	301	194	($440)	$3,637	$637	$3,834	$0	$0	$12,210	3.18	4.85
7670	DENTAL CLINIC	Convert DD to DD w/ VAV	(173)	889	716	($713)	$10,760	$958	$11,006	$0	$0	$40,355	3.67	4.26
602	DENTAL CLINIC	Convert DD to DD w/ VAV	(132)	681	548	($546)	$8,237	$1,242	$8,934	$0	$0	$35,342	3.96	3.94
6940	INDOOR SWIM POOL	Replace H&V with Heat Recovery Unit	7,727	706	8,434	$31,836	$8,545	$0	$40,381	$0	$0	$199,226	4.93	3.61
7245	ENL PERS DIN	Replace Kitchen MAUs and Exhaust Fans with Heat Recovery Units	3,511	103	3,614	$14,465	$1,250	$332	$16,047	$0	$30,377	$90,334	5.14	3.49
7606	ENL PERS DIN	Replace Kitchen MAUs and Exhaust Fans with Heat Recovery Units	3,511	103	3,614	$14,465	$1,250	$332	$16,047	$0	$30,377	$90,334	5.14	3.49
7654	ENL PERS DIN	Replace Kitchen MAUs and Exhaust Fans with Heat Recovery Units	3,511	103	3,614	$14,465	$1,250	$332	$16,047	$0	$30,377	$90,334	5.14	3.49
7804	ENL PERS DIN	Replace Kitchen MAUs and Exhaust Fans with Heat Recovery Units	3,511	103	3,614	$14,465	$1,250	$332	$16,047	$0	$30,377	$90,334	5.14	3.49
7856	ENL PERS DIN	Replace Kitchen MAUs and Exhaust Fans with Heat Recovery Units	3,511	103	3,614	$14,465	$1,250	$332	$16,047	$0	$30,377	$90,334	5.14	3.49
6620	COMMUN ACT CTR	Replace SZ AHUs with VAV AHUs	199	478	677	$821	$5,778	$539	$7,138	$0	$30,326	$47,075	5.44	2.99
7404	ENL BARRACKS W/O DIN	Convert two MZs to VAVs	0	364	364	$0	$4,402	$378	$4,780	$0	$0	$26,055	5.45	2.90
410	ENL BARRACKS W/AS	Replace MZs with VAV AHUs	(730)	997	267	($3,008)	$12,061	$1,309	$10,362	$0	$51,813	$77,512	5.98	2.59
402	ENL BARRACKS W/AS	Replace MZs and SZ with VAV AHUs	(730)	997	267	($3,008)	$12,061	$1,309	$10,362	$0	$49,221	$78,851	6.15	2.52
5000	FIRE STATION	Replace MZ with 3 Furnance AC Units, Replace Boiler with smaller Boiler, and Replace ACCU with 3 smaller ACCUs	196	82	278	$808	$991	($47)	$1,752	$652	$72,986	$41,284	6.82	2.48
7245	ENL PERS DIN	Replace Large Steam Boiler w/ Smaller Steam & HW Boilers	1,528	(111)	1,417	$6,295	($1,338)	$0	$4,957	($181)	$101,942	$72,585	7.35	2.47
6620	COMMUN ACT CTR	Convert MZ to VAV	(9)	176	167	($35)	$2,129	($122)	$1,972	$0	$0	$13,076	6.63	2.40
7804	ENL PERS DIN	Replace Large Steam Boiler w/ Smaller Steam & HW Boilers	1,528	(111)	1,417	$6,295	($1,338)	$0	$4,957	($181)	$101,942	$78,207	7.92	2.29
7856	ENL PERS DIN	Replace Large Steam Boiler w/ Smaller Steam & HW Boilers	1,528	(111)	1,417	$6,295	($1,338)	$0	$4,957	($181)	$101,942	$78,207	7.92	2.29
227	ENL BARRACKS W/AS	Replace MZs and SZs with VAV AHUs	(852)	1,163	311	($3,510)	$14,071	$1,527	$12,089	$0	$70,248	$111,119	7.12	2.18
7806	BN HQ BLDG	Replace SZs with VAV AHUs	(95)	263	168	($392)	$3,183	$735	$3,526	$0	$23,323	$34,973	7.45	2.13
7086	UNIT CHAPEL	Replace SZ with VAV AHU	122	92	214	$504	$1,108	$183	$1,794	$0	$12,554	$19,280	7.96	2.09
222	ADMIN GEN PURP	Replace SZ with VAV AHU	(127)	260	133	($523)	$3,145	$809	$3,431	$0	$14,214	$31,811	7.68	2.03
7606	ENL PERS DIN	Replace Large Steam Boiler w/ Smaller Steam & HW Boilers	1,528	(111)	1,417	$6,295	($1,338)	$0	$4,957	($181)	$101,942	$89,312	9.05	2.01
7654	ENL PERS DIN	Replace Large Steam Boiler w/ Smaller Steam & HW Boilers	1,528	(111)	1,417	$6,295	($1,338)	$0	$4,957	($181)	$101,942	$89,312	9.05	2.01
8069	INDOOR SW POOL/GYM	Replace H&V with Heat Recovery Unit	3,223	295	3,517	$13,277	$3,563	$0	$16,840	$0	$35,706	$173,802	9.33	1.90
7178	MOTOR POOL ADMIN	Replace 3 Win. ACs with small SZ w/ DX coil	0	52	52	$0	$628	$826	$1,454	($141)	$4,071	$12,511	8.25	1.89
7245	ENL PERS DIN	Replace SZ AHUs in Dining Area with VAV AHUs	(279)	287	8	($1,151)	$3,477	$381	$2,707	$0	$21,050	$33,387	8.80	1.74

TABLE 5-3
ECONOMIC SUMMARY FOR PROPOSED HVAC SYSTEM REPLACEMENT

BLDG NO.	BLDG NAME	PROPOSED HVAC SYSTEM TYPE	NAT. GAS ENERGY SAVINGS (MBtu/yr)	ELEC. ENERGY SAVINGS (MBtu/yr)	TOTAL ENERGY SAVINGS (MBtu/yr)	NAT. GAS COST SAVINGS ($/yr)	ELEC. COST SAVINGS ($/yr)	DEMAND kW COST SAVINGS ($/yr)	TOTAL ENERGY COST SAVINGS ($/yr)	ANNUAL MAINT. SAVINGS ($/yr)	NON-RECURRING SAVINGS ($)	TOTAL INVESTMENT ($)	SIMPLE PAYBACK (yrs)	SIR
7606	ENL PERS DIN	Replace SZ AHUs in Dining Area with VAV AHUs	(279)	287	8	($1,151)	$3,477	$381	$2,707	$0	$21,050	$33,387	8.80	1.74
7654	ENL PERS DIN	Replace SZ AHUs in Dining Area with VAV AHUs	(279)	287	8	($1,151)	$3,477	$381	$2,707	$0	$21,050	$33,387	8.80	1.74
7804	ENL PERS DIN	Replace SZ AHUs in Dining Area with VAV AHUs	(279)	287	8	($1,151)	$3,477	$381	$2,707	$0	$21,050	$33,387	8.80	1.74
7856	ENL PERS DIN	Replace SZ AHUs in Dining Area with VAV AHUs	(279)	287	8	($1,151)	$3,477	$381	$2,707	$0	$21,050	$33,387	8.80	1.74
7176	MOTOR POOL MNT SHO	Replace UHs and Steam Boiler with IR Tube Heating System	83	28	112	$343	$344	$0	$688	$600	$24,734	$27,000	10.70	1.56
3	POST CHAPEL	Replace SZ, H&V, Stm Boiler and Cooling Tower with VAV AHU, HW Boiler, and Water Chiller	212	136	348	$874	$1,649	$131	$2,653	$724	$48,583	$68,200	11.75	1.42
820	TAC EQUIP SHOP	Replace HW UHs with Gas-fired Infrared Radiant Tube System; Down size HW Boiler	104	11	115	$427	$133	$0	$560	$370	$43,700	$37,546	12.05	1.42
7739	MOVING TARGET SIMULATOR BLDG	Replace MZ with VAV AHU	(37)	101	65	($151)	$1,227	$283	$1,359	$0	$14,830	$27,484	13.09	1.23
741	MNT HANGAR COMB	Replace Industrial Type UHs with Gas-fired Infrared Radiant Tube System	626	213	839	$2,578	$2,583	$0	$5,161	$600	$63,690	$142,228	15.90	1.07
7602	ADMIN & SUPPLY BLDG	Replace existing SZs with new SZs	0	25	25	$0	$302	$213	$515	$0	$20,550	$24,083	15.62	1.07
7608	ADMIN & SUPPLY BLDG	Replace existing SZs with new SZs	0	25	25	$0	$302	$213	$515	$0	$20,550	$24,083	15.62	1.07
7652	ADMIN & SUPPLY BLDG	Replace existing SZs with new SZs	0	25	25	$0	$302	$213	$515	$0	$20,550	$24,083	15.62	1.07
7658	ADMIN & SUPPLY BLDG	Replace existing SZs with new SZs	0	25	25	$0	$302	$213	$515	$0	$20,550	$24,083	15.62	1.07
6914	EXC MAIN RETL	Convert two MZs to VAVs	(4)	145	141	($18)	$1,757	($18)	$1,722	$0	$0	$29,431	17.09	0.93
7612	ENL BARRACKS W/AS	Replace FCs and SZs with VAV AHUs	2,176	95	2,271	$8,964	$1,151	($1,233)	$8,881	$5,147	$179,196	$434,560	18.90	0.91
7614	ENL BARRACKS W/AS	Replace FCs and SZs with VAV AHUs	2,176	95	2,271	$8,964	$1,151	($1,233)	$8,881	$5,147	$179,196	$434,560	18.90	0.91
7616	ENL BARRACKS W/AS	Replace FCs and SZs with VAV AHUs	2,176	95	2,271	$8,964	$1,151	($1,233)	$8,881	$5,147	$179,196	$434,560	18.90	0.91
7810	ENL BARRACKS W/AS	Replace FCs and SZs with VAV AHUs	2,176	95	2,271	$8,964	$1,151	($1,233)	$8,881	$5,147	$179,196	$434,560	18.90	0.91
7814	ENL BARRACKS W/AS	Replace FCs and SZs with VAV AHUs	2,176	95	2,271	$8,964	$1,151	($1,233)	$8,881	$5,147	$179,196	$434,560	18.90	0.91
8069	INDOOR SW POOL/GYM	Replace H&V with Heat Recovery, Dehumidification, and Pool Heating Unit	3,223	(559)	2,663	$13,277	($6,769)	$0	$6,508	$0	$35,706	$202,172	24.38	0.82
7243	ADMIN & SUPPLY BLDG	Replace 15 Win. ACs with 5 small SZs w/ DX coils	0	50	50	$0	$600	$790	$1,390	($704)	$19,638	$43,596	26.13	0.64
8025	BN ADMIN & CLRM	Convert MZs to VAVs	0	65	65	$0	$791	($112)	$679	$0	$0	$17,282	25.45	0.63
202	PHYS FITNESS CTR	Replace two Industrial Type Unit Heaters in Basketball Gym with four H&V Units	148	20	167	$609	$236	$48	$894	$0	$17,611	$64,001	36.08	0.48

6. RECOMMENDATIONS

6.1 RECOMMENDATIONS FOR HVAC SYSTEM COMPONENTS FOR REPAIR

The HVAC system components are recommended for repair to restore the existing HVAC systems to their intended operating condition. Some of the HVAC systems evaluated overlapped between the analyses for HVAC repair and replacement. Those HVAC systems which qualified economically for replacement were removed from the HVAC components for repair list. The buildings removed from the repair list include Buildings 222, 227, 402, 7245, 7606, 7654, 7804, and 7856. The total cost for the recommended HVAC system components for repair is $56,887. The recommended HVAC system components for repair are presented in Table 6-1 on page 6-2.

6.2 RECOMMENDATIONS FOR HVAC SYSTEM REPLACEMENTS

The HVAC systems are recommended for replacement with more efficient HVAC systems. The 32 proposed HVAC system replacements which qualified for the ECIP funding program are recommended to be submitted for project funding. The recommended HVAC system replacements are presented in Table 6-2 on page 6-3.

The HVAC systems not qualifying for the ECIP funding program were not recommended for replacement. The nonrecommended HVAC system replacements are presented in Table 6-3 on page 6-5.

TABLE 6-1
RECOMMENDED HVAC COMPONENTS FOR REPAIR

TAB	BLDG NO.	BLDG NAME	DESCRIPTION OF HVAC COMPONENTS FOR REPAIR	REPAIR COST ($)
Admin. Buildings 1	302	FINANCE ADMIN	FAN BEARING	91
	313	CIV PERS BLDG	CONDENSER COIL (PLUS COVER)	797
	7636	REGIMENTAL HQ BLDG	CONTROL VALVE 2-1/2"	1,050
	8056	DET DAY ROOM	PUMP, 3/4 HP	744
Admin. & Supply Buildings 2	7602	ADMIN & SUPPORT BLDG	COOLING COIL, 2ROW, 30" x 30", STEEL PIPE SCH. 40, 1.25" W/HANGERS & 1.25" FIBERGLASS PIPE INSULATION, 1.5" THCK	3,914
	7608	ADMIN & SUPPLY BLDG	COOLING COIL, 2ROW, 30" x 30", STEEL PIPE SCH. 40, 1.25" W/HANGERS & 1.25" FIBERGLASS PIPE INSULATION, 1.5" THCK	3,914
	7652	ADMIN & SUPPLY BLDG	COOLING COIL, 2ROW, 30" x 30", STEEL PIPE SCH. 40, 1.25" W/HANGERS & 1.25" FIBERGLASS PIPE INSULATION, 1.5" THCK	3,914
	7658	ADMIN & SUPPLY BLDG	COOLING COIL, 2ROW, 30" x 30", STEEL PIPE SCH. 40, 1.25" W/HANGERS & 1.25" FIBERGLASS PIPE INSULATION, 1.5" THCK	3,914
Barracks Buildings 3	7612	ENL BARRACKS W/AS	PUMP SEAL	208
	7614	ENL BARRACKS W/AS	PUMP SEAL	625
	7810	ENL BARRACKS W/O DIN	PUMP SEAL	417
	7814	ENL BARRACKS W/O DIN	PUMP, 2 HP & PUMP SEAL	1,219
	8002	ENL BARRACKS W/O DIN	CONTROL VALVE 1/2" & 3-SPEED FAN SWITCH	2,227
	8012	ENL BARRACKS W/O DIN	CONTROL VALVE 1/2" & 3-SPEED FAN SWITCH	2,227
	8014	ENL BARRACKS W/O DIN	CONTROL VALVE 1/2" & 3-SPEED FAN SWITCH	1,114
	8038	ENL BARRACKS W/O DIN	CONTROL VALVE 1/2" & 3-SPEED FAN SWITCH	2,227
	8040	ENL BARRACKS W/O DIN	CONTROL VALVE 1/2" & 3-SPEED FAN SWITCH	1,114
	8042	ENL BARRACKS W/O DIN	CONTROL VALVE 1/2" & 3-SPEED FAN SWITCH	2,227
	8048	ENL BARRACKS W/O DIN	CONTROL VALVE 1/2" & 3-SPEED FAN SWITCH	1,114
	8050	ENL BARRACKS W/O DIN	CONTROL VALVE 1/2" & 3-SPEED FAN SWITCH	1,114
	8052	SR ENL QTRS	CONTROL VALVE 1/2" & 3-SPEED FAN SWITCH	2,227
Maintenance Shops 8	723	MNT HANGAR COMB	PUMP SEAL, CONDENSATE PUMP GASKET & CONDENSATE SHUT-OFF CONTROLS	1,439
	727	MNT HANGAR COMB	DAMPER ACTUATOR, PUMP SEAL, CONDENSATE PUMP GASKET, CONDENSATE SHUT-OFF CONTROLS & PUMP MOTOR, 1/3 HP	1,935
	741	MNT HANGAR COMB	REPLACE FOUR STEAM HEATING COILS, 980,000 BTUH CAPACITY EACH	4,975
	820	TAC EQUIP SHOP	CONTROL VALVE 1-1/2", PUMP MOTOR, 10 HP & PUMP SEAL	2,094
	8390	TAC EQUIP SHOP	DAMPER ACTUATOR, CONTROL VALVE 1" & CONTROL VALVE 3/4"	1,975
Recreation & Retail Facilities 9	202	PHYS FITNESS CTR	CONDENSER COIL (PLUS COVER)	979
	6914	EXC MAIN RETL	CONTROL VALVE 1-1/2", CONTROL VALVE 2", CONTROL VALVE 1-1/4" & DAMPER ACTUATOR	2,098
	6940	INDOOR SWIM POOL	DAMPER ACTUATOR	223
	7485	BOWLING ALLEY	VARIABLE SPEED DRIVE W/ CONTRLER, 10 HP	3,459
Simulator Building 10	7739	MOVING TARGET SIMULATOR BLDG	DAMPER ACTUATOR	893
Training Building 11	6620	COMMUN ACT CTR	PUMP SEAL	417
			TOTAL REPAIR COST	**$56,887**

TABLE 6-2
RECOMMENDED HVAC SYSTEM REPLACEMENTS

BLDG NO.	BLDG NAME	PROPOSED HVAC SYSTEM TYPE	NAT. GAS ENERGY SAVINGS (MBtu/yr)	ELEC. ENERGY SAVINGS (MBtu/yr)	TOTAL ENERGY SAVINGS (MBtu/yr)	NAT. GAS COST SAVINGS ($/yr)	ELEC. COST SAVINGS ($/yr)	DEMAND kW COST SAVINGS ($/yr)	TOTAL ENERGY COST SAVINGS ($/yr)	ANNUAL MAINT. SAVINGS ($/yr)	NON-RECURRING SAVINGS ($)	TOTAL INVESTMENT ($)	SIMPLE PAYBACK (yrs)	SIR
7485	BOWLING ALLEY	Convert DD to DD w/ VAV	(293)	488	196	($1,205)	$5,907	$850	$5,552	$0	$0	$15,055	2.71	5.61
7665	DENTAL CLINIC	Convert MZ to VAV	(107)	301	194	($440)	$3,637	$637	$3,834	$0	$0	$12,210	3.18	4.85
7670	DENTAL CLINIC	Convert DD to DD w/ VAV	(173)	889	716	($713)	$10,760	$958	$11,006	$0	$0	$40,355	3.67	4.26
602	DENTAL CLINIC	Convert DD to DD w/ VAV	(132)	681	548	($546)	$8,237	$1,242	$8,934	$0	$0	$35,342	3.96	3.94
6940	INDOOR SWIM POOL	Replace H&V with Heat Recovery Unit	7,727	706	8,434	$31,836	$8,545	$0	$40,381	$0	$0	$199,226	4.93	3.61
7245	ENL PERS DIN	Replace Kitchen MAUs and Exhaust Fans with Heat Recovery Units	3,511	103	3,614	$14,465	$1,250	$332	$16,047	$0	$30,377	$90,334	5.14	3.49
7606	ENL PERS DIN	Replace Kitchen MAUs and Exhaust Fans with Heat Recovery Units	3,511	103	3,614	$14,465	$1,250	$332	$16,047	$0	$30,377	$90,334	5.14	3.49
7654	ENL PERS DIN	Replace Kitchen MAUs and Exhaust Fans with Heat Recovery Units	3,511	103	3,614	$14,465	$1,250	$332	$16,047	$0	$30,377	$90,334	5.14	3.49
7804	ENL PERS DIN	Replace Kitchen MAUs and Exhaust Fans with Heat Recovery Units	3,511	103	3,614	$14,465	$1,250	$332	$16,047	$0	$30,377	$90,334	5.14	3.49
7856	ENL PERS DIN	Replace Kitchen MAUs and Exhaust Fans with Heat Recovery Units	3,511	103	3,614	$14,465	$1,250	$332	$16,047	$0	$30,377	$90,334	5.14	3.49
6620	COMMUN ACT CTR	Replace SZ AHUs with VAV AHUs	199	478	677	$821	$5,778	$539	$7,138	$0	$30,326	$47,075	5.44	2.99
7404	ENL BARRACKS W/O DIN	Convert two MZs to VAVs	0	364	364	$0	$4,402	$378	$4,780	$0	$0	$26,055	5.45	2.90
410	ENL BARRACKS W/AS	Replace MZs with VAV AHUs	(730)	997	267	($3,008)	$12,061	$1,309	$10,362	$0	$51,813	$77,512	5.98	2.59
402	ENL BARRACKS W/AS	Replace MZs and SZ with VAV AHUs	(730)	997	267	($3,008)	$12,061	$1,309	$10,362	$0	$49,221	$78,851	6.15	2.52
5000	FIRE STATION	Replace MZ with 3 Furnance AC Units, Replace Boiler with smaller Boiler, and Replace ACCU with 3 smaller ACCUs	196	82	278	$808	$991	($47)	$1,752	$652	$72,986	$41,284	6.82	2.48
7245	ENL PERS DIN	Replace Large Steam Boiler w/ Smaller Steam & HW Boilers	1,528	(111)	1,417	$6,295	($1,338)	$0	$4,957	($181)	$101,942	$72,585	7.35	2.47
6620	COMMUN ACT CTR	Convert MZ to VAV	(9)	176	167	($35)	$2,129	($122)	$1,972	$0	$0	$13,076	6.63	2.40
7804	ENL PERS DIN	Replace Large Steam Boiler w/ Smaller Steam & HW Boilers	1,528	(111)	1,417	$6,295	($1,338)	$0	$4,957	($181)	$101,942	$78,207	7.92	2.29
7856	ENL PERS DIN	Replace Large Steam Boiler w/ Smaller Steam & HW Boilers	1,528	(111)	1,417	$6,295	($1,338)	$0	$4,957	($181)	$101,942	$78,207	7.92	2.29
227	ENL BARRACKS W/AS	Replace MZs and SZs with VAV AHUs	(852)	1,163	311	($3,510)	$14,071	$1,527	$12,089	$0	$70,248	$111,119	7.12	2.18
7806	BN HQ BLDG	Replace SZs with VAV AHUs	(95)	263	168	($392)	$3,183	$735	$3,526	$0	$23,323	$34,973	7.45	2.13
7086	UNIT CHAPEL	Replace SZ with VAV AHU	122	92	214	$504	$1,108	$183	$1,794	$0	$12,554	$19,280	7.96	2.09
222	ADMIN GEN PURP	Replace SZ with VAV AHU	(127)	260	133	($523)	$3,145	$809	$3,431	$0	$14,214	$31,811	7.68	2.03
7606	ENL PERS DIN	Replace Large Steam Boiler w/ Smaller Steam & HW Boilers	1,528	(111)	1,417	$6,295	($1,338)	$0	$4,957	($181)	$101,942	$89,312	9.05	2.01
7654	ENL PERS DIN	Replace Large Steam Boiler w/ Smaller Steam & HW Boilers	1,528	(111)	1,417	$6,295	($1,338)	$0	$4,957	($181)	$101,942	$89,312	9.05	2.01
8069	INDOOR SW POOL/GYM	Replace H&V with Heat Recovery Unit	3,223	295	3,517	$13,277	$3,563	$0	$16,840	$0	$35,706	$173,802	9.33	1.90
7178	MOTOR POOL ADMIN	Replace 3 Win. ACs with small SZ w/ DX coil	0	52	52	$0	$628	$826	$1,454	($141)	$4,071	$12,511	8.25	1.89
7245	ENL PERS DIN	Replace SZ AHUs in Dining Area with VAV AHUs	(279)	287	8	($1,151)	$3,477	$381	$2,707	$0	$21,050	$33,387	8.80	1.74

TABLE 6-2
RECOMMENDED HVAC SYSTEM REPLACEMENTS

BLDG NO.	BLDG NAME	PROPOSED HVAC SYSTEM TYPE	NAT. GAS ENERGY SAVINGS (MBtu/yr)	ELEC. ENERGY SAVINGS (MBtu/yr)	TOTAL ENERGY SAVINGS (MBtu/yr)	NAT. GAS COST SAVINGS ($/yr)	ELEC. COST SAVINGS ($/yr)	DEMAND kW COST SAVINGS ($/yr)	TOTAL ENERGY COST SAVINGS ($/yr)	ANNUAL MAINT. SAVINGS ($/yr)	NON-RECURRING SAVINGS ($)	TOTAL INVESTMENT ($)	SIMPLE PAYBACK (yrs)	SIR
7606	ENL PERS DIN	Replace SZ AHUs in Dining Area with VAV AHUs	(279)	287	8	($1,151)	$3,477	$381	$2,707	$0	$21,050	$33,387	8.80	1.74
7654	ENL PERS DIN	Replace SZ AHUs in Dining Area with VAV AHUs	(279)	287	8	($1,151)	$3,477	$381	$2,707	$0	$21,050	$33,387	8.80	1.74
7804	ENL PERS DIN	Replace SZ AHUs in Dining Area with VAV AHUs	(279)	287	8	($1,151)	$3,477	$381	$2,707	$0	$21,050	$33,387	8.80	1.74
7856	ENL PERS DIN	Replace SZ AHUs in Dining Area with VAV AHUs	(279)	287	8	($1,151)	$3,477	$381	$2,707	$0	$21,050	$33,387	8.80	1.74
TOTALS FOR ENERGY SAVINGS, COST SAVINGS, AND INVESTMENTS			32,019	9,679	41,698	$131,911	$117,151	$14,698	$263,762	($394)	$1,131,307	$1,995,765	-	-

TABLE 6-3
NONRECOMMENDED HVAC SYSTEM REPLACEMENTS

BLDG NO.	BLDG NAME	PROPOSED HVAC SYSTEM TYPE	NAT. GAS ENERGY SAVINGS (MBtu/yr)	ELEC. ENERGY SAVINGS (MBtu/yr)	TOTAL ENERGY SAVINGS (MBtu/yr)	NAT. GAS COST SAVINGS ($/yr)	ELEC. COST SAVINGS ($/yr)	DEMAND kW COST SAVINGS ($/yr)	TOTAL ENERGY COST SAVINGS ($/yr)	ANNUAL MAINT. SAVINGS ($/yr)	NON-RECURRING SAVINGS ($)	TOTAL INVESTMENT ($)	SIMPLE PAYBACK (yrs)	SIR
7176	MOTOR POOL MNT SHO	Replace UHs and Steam Boiler with IR Tube Heating System	83	28	112	$343	$344	$0	$688	$600	$24,734	$27,000	10.70	1.56
3	POST CHAPEL	Replace SZ, H&V, Stm Boiler and Cooling Tower with VAV AHU, HW Boiler, and Water Chiller	212	136	348	$874	$1,649	$131	$2,653	$724	$48,583	$68,200	11.75	1.42
820	TAC EQUIP SHOP	Replace HW UHs with Gas-fired Infrared Radiant Tube System; Down size HW Boiler	104	11	115	$427	$133	$0	$560	$370	$43,700	$37,546	12.05	1.42
7739	MOVING TARGET SIMULATOR BLDG	Replace MZ with VAV AHU	(37)	101	65	($151)	$1,227	$283	$1,359	$0	$14,830	$27,484	13.09	1.23
741	MNT HANGAR COMB	Replace Industrial Type UHs with Gas-fired Infrared Radiant Tube System	626	213	839	$2,578	$2,583	$0	$5,161	$600	$63,690	$142,228	15.90	1.07
7602	ADMIN & SUPPLY BLDG	Replace existing SZs with new SZs	0	25	25	$0	$302	$213	$515	$0	$20,550	$24,083	15.62	1.07
7608	ADMIN & SUPPLY BLDG	Replace existing SZs with new SZs	0	25	25	$0	$302	$213	$515	$0	$20,550	$24,083	15.62	1.07
7652	ADMIN & SUPPLY BLDG	Replace existing SZs with new SZs	0	25	25	$0	$302	$213	$515	$0	$20,550	$24,083	15.62	1.07
7658	ADMIN & SUPPLY BLDG	Replace existing SZs with new SZs	0	25	25	$0	$302	$213	$515	$0	$20,550	$24,083	15.62	1.07
6914	EXC MAIN RETL	Convert two MZs to VAVs	(4)	145	141	($18)	$1,757	($18)	$1,722	$0	$0	$29,431	17.09	0.93
7612	ENL BARRACKS W/AS	Replace FCs and SZs with VAV AHUs	2,176	95	2,271	$8,964	$1,151	($1,233)	$8,881	$5,147	$179,196	$434,560	18.90	0.91
7614	ENL BARRACKS W/AS	Replace FCs and SZs with VAV AHUs	2,176	95	2,271	$8,964	$1,151	($1,233)	$8,881	$5,147	$179,196	$434,560	18.90	0.91
7616	ENL BARRACKS W/AS	Replace FCs and SZs with VAV AHUs	2,176	95	2,271	$8,964	$1,151	($1,233)	$8,881	$5,147	$179,196	$434,560	18.90	0.91
7810	ENL BARRACKS W/AS	Replace FCs and SZs with VAV AHUs	2,176	95	2,271	$8,964	$1,151	($1,233)	$8,881	$5,147	$179,196	$434,560	18.90	0.91
7814	ENL BARRACKS W/AS	Replace FCs and SZs with VAV AHUs	2,176	95	2,271	$8,964	$1,151	($1,233)	$8,881	$5,147	$179,196	$434,560	18.90	0.91
8069	INDOOR SW POOL/GYM	Replace H&V with Heat Recovery, Dehumidification, and Pool Heating Unit	3,223	(559)	2,663	$13,277	($6,769)	$0	$6,508	$0	$35,706	$202,172	24.38	0.82
7243	ADMIN & SUPPLY BLDG	Replace 15 Win. ACs with 5 small SZs w/ DX coils	0	50	50	$0	$600	$790	$1,390	($704)	$19,638	$43,596	26.13	0.64
8025	BN ADMIN & CLRM	Convert MZs to VAVs	0	65	65	$0	$791	($112)	$679	$0	$0	$17,282	25.45	0.63
202	PHYS FITNESS CTR	Replace two Industrial Type Unit Heaters in Basketball Gym with four H&V Units	148	20	167	$609	$236	$48	$894	$0	$17,611	$64,001	36.08	0.48

6.3 RECOMMENDED ENERGY RETROFIT PROJECTS FOR HVAC UPGRADE

Five energy retrofit projects were identified for HVAC upgrade by the Fort Riley Public Works Energy Branch. These projects were recommended for funding under the Federal Energy Management Program (FEMP). The five projects are presented in Table 6-4.

Table 6-4. HVAC Energy Retrofit Projects Recommended for FEMP

Project No.	Project Description
Project No. 1	**Upgrade HVAC Systems in Dental Clinics (see TAB 6)**
	• Building 602 - Convert DD AHU to DD VAV AHU
	• Building 7665 - Convert MZ AHU to VAV AHU
	• Building 7670 - Convert DD AHU to DD VAV AHU
Project No. 2	**Upgrade HVAC Systems in Dining Facilities (see TAB 7)**
	• Building 7245 - Replace SZ AHUs with VAV AHUs - Replace MAUs with HRUs - Replace large STM BLR with smaller HW BLR and smaller STM BLR
	• Building 7606 - Replace SZ AHUs with VAV AHUs - Replace MAUs with HRUs - Replace large STM BLR with smaller HW BLR and smaller STM BLR
	• Building 7654 - Replace SZ AHUs with VAV AHUs - Replace MAUs with HRUs - Replace large STM BLR with smaller HW BLR and smaller STM BLR
Project No. 3	**Upgrade HVAC Systems in Indoor Swimming Pool Buildings (see TAB 9)**
	• Building 6940 - Replace H&V with HRU
	• Building 8069 - Replace H&Vs with HRUs
Project No. 4	**Upgrade HVAC Systems in Bowling Alley and Community Activiities Center**
	• Building 7485 (Bowling Alley) - Convert DD AHU to DD VAV AHU (see TAB 9)
	• Building 6620 (Community Activities Center) - Replace SZ AHUs with VAV AHUs - Convert MZ AHU to VAV AHU (see TAB 11)

Project No.	Project Description
Project No. 5	**Upgrade HVAC Systems in Fire Station, Unit Chapel, Motor Pool Admin, and Battalion Headquarters**
	• Building 5000 (Fire Station) BLR (see TAB 1) - Replace MZ AHU with three Furnace Air Conditioners - Replace ACCU with three Smaller ACCUs - Replace HW Boiler with Smaller Modular HW
	• Building 7086 (Unit Chapel) (see TAB 5) - Replace SZ AHU with VAV AHU
	• Building 7178 (Motor Pool Admin) (see TAB 1) - Replace three WACs with SZ AHU and ACCU
	• Building 7806 (Battalion Headquarters) (see TAB 4) - Replace SZ AHU with VAV AHUs

DD 1391 Forms and LCCAs for each of the five FEMP energy retrofit projects are presented in Appendix F. The energy savings and economic parameters for the projects are presented in Table 6-5 on page 6-8.

TABLE 6-5
ECONOMIC SUMMARY FOR ENERGY RETROFIT PROJECTS

FEMP ENERGY RETROFIT PROJECT FOR HVAC UPGRADE	NAT. GAS ENERGY SAVINGS (MBtu/yr)	ELEC. ENERGY SAVINGS (MBtu/yr)	TOTAL ENERGY SAVINGS (MBtu/yr)	NAT. GAS COST SAVINGS ($/yr)	ELEC. COST SAVINGS ($/yr)	DEMAND kW COST SAVINGS ($/yr)	TOTAL ENERGY COST SAVINGS ($/yr)	ANNUAL MAINT. SAVINGS ($/yr)	NON-RECURRING SAVINGS ($)	TOTAL INVESTMENT ($)	SIMPLE PAYBACK (yrs)	SIR
Project No. 1 Dental Clinics (Bldgs 602, 7665, 7670)	(412)	1,871	1,459	($1,697)	$22,639	$2,837	$23,779	$0	$0	$87,908	3.70	4.22
Project No. 2 Dining Facilities (Bldgs 7245, 7606, and 7654)	14,280	837	15,117	$58,834	$10,128	$2,139	$71,100	($543)	$460,107	$622,370	6.65	2.66
Project No. 3 Indoor Swimming Pools (Bldgs 6940 and 8069)	10,950	1,001	11,951	$45,114	$12,112	$0	$57,226	$0	$35,706	$373,029	6.32	2.81
Project No. 4 Bowling Alley and Comm. Act. Center (Bldgs 7485 and 6620)	(103)	1,142	1,039	($424)	$13,818	$1,267	$14,661	$0	$30,326	$75,206	4.65	3.41
Project No. 5 Fire Station, Unit Chapel, Motor Pool Admin, and Bn HQ (Bldgs 5000, 7086, 7178, and 7806)	223	489	712	$919	$5,917	$1,697	$8,533	$511	$112,934	$108,048	7.36	2.23

APPENDIX A

SCOPE OF WORK

CEMRKED-MF

23 AUGUST 1994
REVISED 24 AUGUST 1994
REVISED 25 AUGUST 1994

GENERAL SCOPE OF WORK

FOR

FEASIBILITY STUDY FOR

HVAC UPGRADE

FORT RILEY, KANSAS

Performed as part of the

ENERGY ENGINEERING ANALYSIS PROGRAM (EEAP)

RHVAC24

SCOPE OF WORK
FEASIBILITY STUDY
FOR
HVAC UPGRADE, FORT RILEY, KS

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ANNEXES

1. BRIEF DESCRIPTION OF WORK: The Architect-Engineer (AE) shall:

1.1 Review for general information the available design, construction, and operation data for the HVAC systems.

1.2 Perform a detailed site survey of selected buildings or facilities to verify construction features, electrical and mechanical equipment, occupancy, and mode of operation for energy analysis; and to evaluate the condition of existing HVAC equipment and controls. A total of 70 buildings will be evaluated for HVAC repair and replacement. The 70 buildings will be selected based on data collected during the UEMCS field survey and in consultation with the Fort Riley DEH.

1.3 Evaluate failed or failing HVAC systems identified during the survey to determine necessary repairs. Provide recommendations with potential energy savings and economic feasibility for replacing the systems in approximately 30% of the builings with more efficient systems.

1.4 Provide complete programming or implementation documentation for all recommended projects.

1.5 Prepare a comprehensive report to document the work performed, the results and the recommendations.

2. GENERAL

2.1 This study is intended to identify and evaluate replacement of failed or failing HVAC equipment. All buildings shall be prioritized according to simple payback and need.

2.2 The information and analysis outlined herein are considered to be minimum essentials for adequate performance of this study.

2.3 For the purposes of this scope of work, an Energy Conservation Opportunity (ECO) is defined as the replacement of the HVAC system or controls within a particular building or facility. A project is defined as the replacement of the HVAC system or controls in one or more buildings/facilities.

2.4 The AE shall ensure that all ECOs pertaining to HVAC system replacement which will reduce the energy consumption or cost of operation of the installation have been considered and

documented per the detailed scope of work. Only one replacement HVAC system will be evaluated for each existing HVAC system.

2.5 The study shall include the energy consuming buildings or facilities listed in paragraph 1.2 above. Field work and calculations may be reduced somewhat by building repetition.

2.6 Computer modeling will be used to determine the energy savings of ECOs for typical buildings. The typical buildings are listed in the Detailed Scoipe of Work, Annex A. The results of these calculations may be applied to buildings which are similar to the typical buildings. To be considered similar, a building must be essentially identical to the typical building in size, floor plan, mechanical equipment, type of construction, condition of equipment and occupancy. If a building is identical to a typical building in all respects except that the occupancy has been changed (e.g., a barracks converted into offices) the building should not be considered similar. In some cases, differences in physical orientation may not allow buildings to be treated as similar; but it is anticipated that in most cases, physical orientation will not be a significant factor. Modeling will be done using a professionally recognized and proven computer program or programs that integrate architectural features with air-conditioning, heating, lighting and other energy-producing or consuming systems. These programs will be capable of simulating the features, systems, and thermal loads of the building under study. The program will use established weather data files and may perform calculations on a true hour-by-hour basis or may condense the weather files and the number of calculations into several "typical" days per month. The Detailed Scope of Work, Annex A, lists programs that are acceptable to the Contracting Officer. If the AE desires to use a different program, it must be submitted for approval with a sample run, an explanation of all input and output data, and a summary of program methodology and energy evaluation capabilities. This requirement to use computer modeling for typical buildings applies only to heated and air conditioned or air-conditioned-only buildings which exceed 8,000 square feet or heated-only buildings in excess of 20,000 square feet.

2.7 The "Energy Conservation Investment Program (ECIP) Guidance", described in letter from DAIM-FDF-U, dated 10 JAN 1994, establishes criteria for ECIP projects and shall be used for performing the economic analyses of all ECOs and projects. Construction cost escalation for DD Form 1391 submission shall be calculated using the guidelines contained in AR 415-17 and the latest Tri-Service MCP Index. The Tri-Service MCP Index, when

updated, is contained in the latest applicable edition of the Engineer Improvement Recommendation System (EIRS) bulletin.

2.8 Energy conservation opportunities determined to be technically and economically feasible shall be developed into projects acceptable to installation personnel. This may involve combining similar buildings/projects into larger packages which will qualify for ECIP or OMA funding, and determining, in coordination with installation personnel, the appropriate packaging and implementation approach for all feasible ECOs.

2.9 Projects which qualify for ECIP funding shall be identified, separately listed, and prioritized by the Savings to Investment Ratio (SIR).

2.10 All feasible non-ECIP projects shall be ranked in order of highest to lowest SIR.

3. <u>PROJECT MANAGEMENT</u>

3.1 <u>Project Managers</u>. The AE shall designate a project manager to serve as a point of contact and liaison for work required under this contract. Upon award of this contract, the individual shall be immediately designated in writing. The AE's designated project manager shall be approved by the Contracting Officer prior to commencement of work. This designated individual shall be responsible for coordination of work required under this contract. The Contracting Officer will designate a project manager to serve as the Government's point of contact and liaison for all work required under this contract. This individual will be the Government's representative.

3.2 <u>Installation Assistance</u>. The Commanding Officer at each installation will designate an individual who will serve as the point of contact for obtaining information and assisting in establishing contacts with the proper individuals and organizations as necessary to accomplish the work required under this contract.

3.3 <u>Public Disclosures</u>. The AE shall make no public announcements or disclosures relative to information contained or developed in this contract, except as authorized by the Contracting Officer.

3.4 <u>Meetings</u>. Meetings will be scheduled whenever requested by the AE or the Contracting Officer for the resolution of questions or problems encountered in the performance of the work. The AE and/or the designated representative(s) shall be required

to attend and participate in all meetings pertinent to the work required under this contract as directed by the Contracting Officer. These meetings, if necessary, are in addition to the presentation and review conferences.

3.5 Site Visits, Inspections, and Investigations. The AE shall visit and inspect/investigate the site of the project as necessary and required during the preparation and accomplishment of the work.

3.6 Records

3.6.1 The AE shall provide a record of all significant conferences, meetings, discussions, verbal directions, telephone conversations, etc., with Government representative(s) relative to this contract in which the AE and/or designated representative(s) thereof participated. These records shall be dated and shall identify the contract number, and modification number if applicable, participating personnel, subject discussed and conclusions reached. The AE shall forward to the Contracting Officer within ten calendar days, a reproducible copy of the records.

3.6.2 The AE shall provide a record of requests for and/or receipt of Government-furnished material, data, documents, information, etc., which if not furnished in a timely manner, would significantly impair the normal progression of the work under this contract. The records shall be dated and shall identify the contract number and modification number, if applicable. The AE shall forward to the Contracting Officer within ten calendar days, a reproducible copy of the record of request or receipt of material.

3.7 Interviews. The AE and the Government's representative shall conduct entry and exit interviews with the Director of Engineering and Housing before starting work at the installation and after completion of the field work. The Government's representative shall schedule the interviews at least two weeks in advance.

3.7.1 Entry. The entry interview shall thoroughly describe the intended procedures for the survey and shall be conducted prior to commencing work at the facility. As a minimum, the interview shall cover the following points:

a. Schedules.

b. Names of energy analysts who will be conducting the site survey.

c. Proposed working hours.

d. Support requirements from the Director of Engineering and Housing.

3.7.2 Exit. The exit interview shall include a thorough briefing describing the items surveyed and probable areas of energy conservation. The interview shall also solicit input and advice from the Director of Engineering and Housing.

4. SERVICES AND MATERIALS. All services, materials (except those specifically enumerated to be furnished by the Government), labor, superintendence and travel necessary to perform the work and render the data required under this contract are included in the lump sum price of the contract.

5. PROJECT DOCUMENTATION. All energy conservation opportunities or projects which the AE has considered shall be included in one of the following categories and presented in the report as such:

5.1 ECIP Projects. An ECIP project is one that proposes new construction or a retrofit of an existing facility for the purpose of conserving energy. In an ECIP project, savings may come from energy, demand, operations and maintenance, or a combination of the above. To qualify as an ECIP project, an ECO or project must have a construction cost estimate greater than $300,000, a Savings to Investment Ratio greater than or equal to 1.25 and a simple payback period of less than ten years. The AE shall check with the installation for guidance. The overall project and each discrete part of the project shall have a SIR greater than 1.25. For all projects meeting the above criteria, complete programming documentation will be required. Programming documentation shall consist of a DD Form 1391, and life cycle cost analysis summary sheet(s) with necessary backup data to verify the numbers presented. A life cycle cost analysis summary sheet shall be developed for each ECO and for the overall project when more than one building are combined.

5.2 Non-ECIP Projects. Projects which normally do not meet ECIP criteria, but which have an overall SIR greater than 1.25 shall be documented. The life cycle cost analysis summary sheet shall be completed for all ECOs or projects. Each shall be analyzed to determine if it is feasible even if it does not meet ECIP criteria. For ECOs or projects in this category, the life

cycle cost analysis summary sheet, completely filled out, with all the necessary backup data to verify the numbers presented, a complete description of the project and the simple payback period shall be included in the report. Additionally, these projects shall have the necessary documentation prepared, in accordance with the requirements of the Government's representative, for one of the following categories:

a. O & M Energy Projects: An O & M Energy project is one that results in needed maintenance or repair to an existing facility, or replaces a failed or failing existing facility, and also results in energy savings. The criteria are similar to the criteria for ECIP projects, i.e., $ 300,000 construction cost, SIR > 1.25, and simple payback period of less than ten years. In addition, if the project would replace a system or equipment that is considered 'failed or failing' due solely to obsolete technology or inefficiency, the equiment to be replaced must have been in use for at least three years; and the simple payback period must be three years or less.

b. Low Cost/No Cost Projects. These are projects which the Director of Engineering and Housing can perform using his resources.

5.3 Nonfeasible ECOs. All buildings/facilites which the AE has considered but which are not feasible for replacement of controls or connection to the new UEMCS shall be documented in the report with reasons and justifications showing why they were rejected.

6. DETAILED SCOPE OF WORK. The detailed Scope of Work is contained in Annex A.

7. WORK TO BE ACCOMPLISHED.

7.1 Review Data for Existing HVAC SYSTEMS. The AE shall review for general information the construction drawings and specifications and the manufacturer's drawings and operations and maintenance manuals for the existing HVAC systems. This review should acquaint the AE with the details used in the existing system. Much of the information the AE may need to perform his evaluations will be contained in this data.

7.2 Perform a Limited Site Survey. The AE shall determine, based on information provided by the installation, which buildings are "typical" and which are "similar" as defined in paragraph 2.6. If different buildings are basically similar but

the condition of the equipment is different, the buildings are not similar. A limited field survey of all buildings listed in the detailed scope of work shall be conducted to verify and/or adjust the list of "typical" and similar" buildings. A detailed field investigation will then be made of all "typical" buildings using the outline provided in the detailed scope of work. This will include evaluating the condition of existing HVAC equipment and controls. The AE shall document his site survey on forms developed for the survey and submit these completed forms as part of the report. Testing is not required.

7.3 Evaluate ECOS/Projects. The ECOs and projects identified in paragraph 1.3 shall be analyzed in detail to determine their feasibility. Savings-to-Investment Ratios (SIRs) shall be determined using current ECIP guidance. The AE shall provide all data and calculations needed to support these analyses. All assumptions shall be clearly stated. Calculations shall be prepared showing how all numbers in the ECO were figured. Calculations shall be in an orderly step-by-step progression from the first assumption to the final number. Descriptions of the products, manufacturers catalog cuts, pertinent drawings or sketches, and input/output (I/O) summary sheets shall also be included. A life cycle cost analysis summary sheet shall be prepared for each ECO or project and shall be included as part of the supporting data. Provide a LCCID summary for each reccomended project developed.

7.4 Provide Programming or Implementation Documentation. For projects or ECOs developed during this study, complete programming or implementation documentation shall be prepared by the AE.

7.4.1 Programming Documentation. For buildings or projects which meet ECIP criteria and which the installation wants to submit as an ECIP project, complete programming documentation shall be prepared. Complete programming documentation consists of DD Form 1391, and supporting data. These forms shall be separate from the narrative report. They shall be bound similarly to the final report in a manner which will facilitate repeated disassembly and reassembly. A maximuim of five 1391's shall be furnished.

7.4.1.1 Military Construction Project Data (DD Form 1391). These documents shall be prepared in accordance with AR 415-15 and the supplemental requirements in Annex B. A complete DD Form 1391 shall be prepared for each project. The form shall include a statement that the project results from an EEAP study.

Documents shall be complete as required for submission to higher DA headquarters. These programming documents will require review and signatures by the proper installation personnel. All documents shall be completed except for the required signatures. The Installatiuon will enter the Forms into the DD 1391 processor.

7.4.2 Implementation Documentation. For feasible projects or ECOs which do not meet ECIP criteria, implementation documentation shall be prepared. Each feasible project or ECO shall be individually packaged, fully documented, and included as a separate section in the volume containing the programming documentation. Each project or ECO shall have a complete description of work to be done, economic justifications, sketches, I/O summary sheets, and other backup data included as a section in the report. The documentation required will be as determined by the Government's representative. Documentation required will be in the categories listed in paragraph 5.2. For low cost/no cost projects which the Director of Engineering and Housing personnel can perform, the following information shall be provided:

a. Brief description of the project.

b. Brief description of the reasons for the modification.

c. Specific instructions for performing the modification.

d. Estimated dollar and energy savings per year.

e. Estimated manhours and labor and materials costs. Costs shall be calculated for the current calendar year and so marked. Manhours shall be listed by trade.

Separate sheets for each project showing the above information shall be prepared and included in the report.

7.5 Submittals, Presentations and Reviews. The work accomplished shall be fully documented by a comprehensive report. The report shall have a table of contents and be indexed. Tabs and dividers shall clearly and distinctly divide sections, subsections, and appendices. All pages shall be numbered. The AE shall give a formal presentation of all but the final submittal to installation, command, and other Government personnel. The AE shall prepare slides or view graphs showing the results of the study to date for his presentation. During the presentation, the personnel in attendance shall be given ample opportunity to ask

questions and discuss any changes deemed necessary to the study. A review conference will be conducted the same day, following the presentation. Each comment presented at the review conference will be discussed and resolved or action items assigned. The AE shall provide the comments from all reviewers and written notification of the action taken on each comment to all reviewing agencies within three weeks after the review meeting. It is anticipated that each presentation and review conference will require approximately one working day. The presentation and review conferences will be at the installation on the date(s) agreeable to the Director of Engineering and Housing, the AE and the Government's representative. The Contracting Officer may require a resubmittal of any document(s), if such document(s) are not approved because they are determined by the Contracting Officer to be inadequate for the intended purpose.

7.5.1 Interim Submittal. An interim report shall be submitted for review after the field survey has been completed and an analysis has been performed on all of the ECOs. The report shall indicate the work which has been accomplished to date, illustrate the methods and justifications of the approaches taken and contain a plan of the work remaining to complete the study. I/O summary sheets and calculations showing energy and dollar savings and SIRs of all ECOs/projects shall be included. The simple payback period of all ECOs/projects shall be calculated and shown in the report. The AE shall submit the Scope of Work and any modifications to the Scope of Work as an appendix to the report. A narrative summary describing the work and results to date shall be a part of this submittal. During the review period, the Government's representative shall coordinate with the Director of Engineering and Housing and provide the AE with direction for packaging or combining ECOs for programming purposes and also indicate the fiscal year for which the programming or implementation documentation shall be prepared. A sample implementation document (DD Form 1391, sketches and manufacturers data, I/O summary sheets, life cycle cost analysis summary sheet and supporting data) for one project shall be submitted with this submittal for review and approval. The survey forms completed during this audit shall be submitted with this report. The survey forms only may be submitted in final form with this submittal. They should be clearly marked at the time of submission that they are to be retained. They shall be bound in a standard three-ring binder which will allow repeated disassembly and reassembly of the material contained within.

7.5.2 Prefinal Submittal. The AE shall prepare and submit the prefinal report when all sections of the report are complete.

The AE shall submit the Scope of Work for the installation studied and any modifications to the Scope of Work as an appendix to the submittal. The report shall integrate all aspects of the study. The report shall list the recommended projects in order of descending SIR. The synergistic effects of all of the applications programs proposed for any particular building shall have been determined and the results of the original calculations adjusted accordingly. Completed programming and implementation documents for all recommended projects shall be included. The programming and implementation documents shall be ready for review and signature by the installation commander. The prefinal report, separately bound Executive Summary and all appendices shall be bound in standard three-ring binders which will allow repeated disassembly and reassembly. The prefinal submittal shall be arranged to include (a) a separately bound Executive Summary to give a brief overview of what was accomplished and the results of this study using graphs, tables and charts as much as possible (See Annex C for minimum requirements), (b) the narrative report containing a copy of the Executive Summary at the beginning of the volume and describing in detail what was accomplished and the results of this study, (c) appendices to include the detailed calculations and all backup material and (d) the programming and implementation documentation. A list of all projects and ECOs developed during this study shall be included in the Executive Summary and shall include the following data from the life cycle cost analysis summary sheet: the cost (construction plus SIOH), the annual energy savings (type and amount), the annual dollar savings, the SIR, the simple payback period and the analysis date. For all programmed projects also include the year in which it is programmed and the programmed year cost.

7.5.3 Final Submittal. Any revisions or corrections resulting from comments made during the review of the prefinal report or during the presentation and review conference shall be incorporated into the final report. These revisions or corrections may be in the form of replacement pages, which may be inserted in the prefinal report, or complete new volumes. Pen and ink changes or errata sheets will not be acceptable. If replacement pages are to be issued, it shall be clearly stated with the prefinal submittal that the submitted documents will be changed only to comply with the comments made during the prefinal conference and that the volumes issued at the time of the prefinal submittal should be retained. Failure to do so will require resubmission of complete volumes. If new volumes are submitted, they shall be in standard three-ring binders and shall contain all the information presented in the prefinal report with any necessary changes made. Detailed instructions of what to do

with the replacement pages should be securely attached to the replacement pages.

ANNEX A

DETAILED SCOPE OF WORK

1. LOCATION

a. GENERAL DESCRIPTION. The Architect Engineer (AE) shall furnish all services, materials, supplies, labor, equipment, investigations, studies, and travel as required in connection with the feasibility study for the below identified project in accordance with the contract and all furnished instructions:

INSTALLATION	DESCRIPTION
Ft. Riley, Ks.	HVAC UPGRADE

b. The project consists of evaluating failed or failing HVAC systems identified during the survey to determine necessary repairs in buildings to be determined in accordance with paragraph 1.2 of the General Scope of Work.

2. AUTHORIZATION. The feasibility study for this project is authorized by Memorandum CEMP-ET, Subject: Energy Engineering Analysis Program (EEAP)-FY94 dated 7 December 1993 and Memorandum CESAM-EN-DM, Subject: Energy Analysis Program (EEAP), FY94 Supplemental Program for Kansas City Distruict dated 10 Auugust 1994. The AE shall make reference to this authority in the study.

3. STUDY INSTRUCTIONS. If the Design Manuals, Guide Specifications, and/or Project Engineering Instructions do not cover a specific condition in question, the AE shall contact the Contracting Officer before proceeding. If there is a conflict in Engineering Instructions or other reference data, such questions or conflicts should be brought to the attention of the Contracting Officer before proceeding.

4. THE INSTALLATION REPRESENTATIVE for this contract will be Mr. Keith Jevons, Project Manager, Directorate of Engineering and Housing, telephone number 913-239-2044. The Kansas Ciity District Project Manager will be Mr. Robert Miller, telephone number 816-426-7348. The Authorized Representative of the Contracting Officer will be Mr. Michael Whitacre, telephone number 816-426-2781.

5. <u>COMPLETION AND PAYMENT SCHEDULE</u>: The following schedule shall be used as a guide in approving payments on this contract. The interim report shall be due not later than 180 days after Notice to Proceed. The prefinal report shall be due not later than 30 days after the interim report review conference. The final report shall be due not later than 21 days after the prefinal review conference.

MILESTONE	PERCENT OF CONTRACT AMOUNT AUTHORIZED FOR PAYMENT
Entry Interview	10
Completion of Field Work	25
Receipt of Interim Submittal	75
Completion of Interim Presentation & Review	85

6. <u>METHOD OF PAYMENT.</u>

a. Title I. The AE shall prepare and submit to the US Army Engineer District, Kansas City, partial payment estimates in accordance with the attachment entitled "Instructions for Completion of ENG Form 93." All partial payments shall be based on work completed as of the 15th day of the report month and shall be submitted to the office of the Contracting Officer by the 18th day of the month. Payment under this contract, for which property or services are provided in a series of partial executions or deliveries, will be made within 30 days after receipt of an invoice which has been properly executed by the AE.

b. Additional Conferences. Payment for furnishing the services of technically qualified representatives to attend additional conferences, when so requested in writing by the Contracting Officer, will be made at a rate per hour for the discipline involved plus travel expenses computed in accordance with Government Joint Travel Regulations in effect at the time travel is performed and actual cost of transportation.

7. <u>THE SIMULATION PROGRAMS</u> acceptable for use in this study are listed below. Any substitutes must be submitted and approved as outlined in the basic scope of work.

a. Building Loads and System Thermodynamics (BLAST)

b. DOE 2.1D

c. Carrier E20 or Hourly Analysis Program (HAP)

d. Trane Air-Conditioning Economics (TRACE)

e. Beacon

8. A COMPUTER PROGRAM titled Life Cycle Costing in Design (LCCID) is available from the BLAST Support Office in Urbana, Illinois for a nominal fee. This computer program can be used for performing the economic calculations for ECIP and non-ECIP ECOs. The AE is encouraged to obtain and use this computer program or may use their in-house program. The BLAST Support Office can be contacted at 144 Mechanical Engineering Building, 1206 West Green Street, Urbana, Illinois 61801. Telephone number is (217) 333-3977 or (800) 842-5278.

9. FACILITY SURVEY

The Architect-Engineer (AE) shall conduct a survey of the buildings and building systems listed in accordance with Appendix B of TM 5-815-2 and as described herein. Each building/system shall be observed while operating. This survey shall include and document the following items:

a. Nameplate information such as manufacturer, horsepower, voltage, current, and other required data shall be recorded for each piece of equipment to be included in the system.

b. Conditions/deficiencies shall be noted for each piece of equipment and each piping or duct system.

10. AUTOMATED REVIEW MANAGEMENT SYSTEM (ARMS).

a. The AE, as a part of this scope of work, shall interface with and utilize the Corps of Engineers Automated Review Management System for this project. The AE will receive one copy of CESPK-PAM 1110-1-2, AE Response Package (User's Manual) describing the communications software, optimum hardware requirements and access procedures. The necessary software is included with the manual. Minimum requirements are an IBM-XT or compatible computer system running DOS 3.0 or later, with 640 kilobyte (KB) RAM, at least a 20 megabyte (MB) hard disk and a 1200 or higher baud Hayes-compatible modem operating. Assistance can be received via a telephone hotline at 916-551-3126.

b. All design review comments and responses will be electronically transmitted from the Corps of Engineer, Missouri River Division, by the ARMS. Comments can be received at a

personal computer in the AE's office by use of ARMS software and a modem over telephone lines. The comments reside on the Missouri River Division computer. The AE can then download the review comments, respond to the comments, upload the comments back to the Division computer and forward responses to the Project Manager.

11. GOVERNMENT-FURNISHED DATA.

a. "Energy Monitoring & Control Systems Technical Manual" TM 5-815-2/AFM 88-36/ NAVFAC DM 4.9

b. AR 415-15 Military Construction, Army (MCA) Program Developement

c. AR 415-20 Project Development and Design Approval

d. Engineering Instructions (as applicable)

e. Latest Tri-Service Cost Index.

f. DAIM-FDF-U letter dated 10 January 1994, "Energy Conservation Investment Program (ECIP) Guidance".

12. SUBMITTAL REQUIREMENTS.

ORGANIZATION	COPIES REQUIRED (Correspondence);	Interim & Prefinal Review	(Final)
Commander 1st Infantry Division (Mech) & Fort Riley ATTN: AFZN-DE-E/ Mr. Jevons Building 408 Fort Riley, Kansas 66442-5000	(1)	3***	(3)
District Engineer U.S. Army Engineer District, Kansas City ATTN: CEMRKED-MF(MILLER) 700 Federal Building Kansas City, Missouri 64106	(1)	3***	(3)
Division Engineer U.S.Army Engineer Division Missouri River ATTN: CEMRDMP-A(Jagasits) 12565 W. Center Road Omaha, NE 68144-3869	(1)	3***	(1)
Commander H.Q. Forscom ATTEN: AFPI-ENO/ Mr. Kapur Fort McPherson, Ga. 30330-6000	(1)	1	(1)
HQDA ODCSLOG ATTN: DALO-TSE (Maj. Wilson) Pentagon Washington, D.C. 20310-0561			(1)*
Commander U.S. Army Corps of Engineers ATTN: CEMP-ET (Mr. Gentil) 20 Massachusetts Avenue, NW Washington, DC 20314-1000		1*	(1)*

Commander U.S. Army Engineer District, Mobile ATTN: CESAM-EN-DM (Mr. Battaglia) P.O. Box 2288 Mobile, AL 36628-1000	(1)	1	(1)
Commander U.S Army Logistics Evaluation Agency ATTN: LOEA-PL (Mr. Keath) New Cumberland Army Depot New Cunberland, PA. 17070-5007			(1)*

* Executive Summary only
*** Computer printout

BUILDINGS THAT ARE NOT NOW CONNECTED TO THE UEMCS SYSTEM
LISTED IN ORDER OF PRIORITY

BUILDING	OCCUPANCY	SQ FT	CONDITION	NOTE
7670	Dental Clinic	14,960	Fair	
7632*	Gymnasium	20,694	Fair	
7832	Gymnasium	20,694	Fair	
741	Maint Hanger Comb	38,898	Fair	
7665*	Dental Clinic	11,076	Fair	
602	Dental Clinic	11,557	Fair	
722	Flight Simulator	7,000	Poor	
724*	Flight Simulator	13,188	Good	
8063	Enl Pers Dine	18,313	Poor	
7024	Gymnasium	20,619	Fair	
223	Enlisted Barrack W/DAS	47,794	Poor	1
727*	Mnt Hanger Comb	36,172	Good	
7622	Bn Admin & Clrm	12,380	Fair	
7824	Bn Admin & Clrm	12,246	Fair to Good	
7836	Bn Admin & Clrm	12,246	Fair to Good	
6914*	Exc Main Retl	63,930	Fair	5, 9
7404	Enl Barracks W/O Dining	50,967	Fair	
7424	Enl Barracks W/O Dining	50,967	Fair	
6620	Commum Act Ctr	31,740	Fair	9
7108	Bn Admin & Clrm	12,527	Good	6
7109	Bn Admin & Clrm	13,535	Good	
7620	Bn Admin & Clrm	6,340	Fair	
7624	Bn Admin & Clrm	6,158	Fair	
8025	Bn Admin & Clrm	12,000	Poor	
8037	Bn Admin & Clrm	12,000	Poor	
7820	Bn Admin & Clrm	6,673	Fair	
8071	Rgt HQ Bldg	9,963	Poor	
817	Mnt Hanger Avum	40,061	Fair	
802	Bn Admin & Clrm	12,526	Good	
804	Rgt HQ Build	10,241	Good	
806	Comb AC-HTG Plant	1,000	Good	
808	Bn Admin & Clrm	12,526	Good	
810	Adm & Support Building	15,152	Good	
812	Adm & Support Building	23,559	Good	
814	Medical Facility	Not Listed	New	
7485	Bowling Alley	36,966	Very Poor	
7806	Bn HQ Bldg	13,493	Fair to Good	
223	Enl Bks W/DAS	47,794	Poor	1
500	Post HQ Building	65,453	Fair to Good	9
404	Enlisted Barrack W/DAS	35,718	Poor	1
853	Mnt Hanger Avum	48,112	Fair	
840	Vehicle Mnt Shop Org.	9,152	Good	

206	Theater W/O Dressing Rm	10,754	Poor	
200	Admin General Purp.	60,690	Fair to Good	9
7920	Veh Mnt Shop DS	124,553	Fair	
751	AC Pts & TOE ST	9,834	Fair	
210	Military Personel Building	58,448	Good	9
7243	Admin & Sup Bldg	17,829	Fair	
7285	Clothing Sales	17,042	Fair	
8069*	IN SW Pool/Gym	25,620	Fair	9
7253	Finance Admin Buldg	52,400	Good	
202	Physical Fitness Ctr.	51,307	Fair	
7630	Bn Admin & Clrm	6,158	Fair	
7638	Bn Admin & Clrm	6,158	Fair	
7270	Bn. HQ Bldg	6,130	Fair to Good	
6918	Skill Development Center	11,507	Good	
402	Enlisted Barracks W/AS	35,718	Poor	
409*	Enlisted Barracks W/AS	32,883	Poor	2
410	Enlisted Barracks W/AS	32,883	Poor	
411	Enlisted Barracks W/AS	32,883	Poor	
6940	Indoor Swimming Pool	23,347	Poor	3
7350	Veh Mnt Shop Org	21,345	Fair	
7500	Veh Mnt Shop Org	22,325	Good	9
7720	Veh Mnt Shop Org	22,325	Good	9
7740	Veh Mnt Shop Org	22,325	Good	9
7960	Veh Mnt Shop Org	20,245	Good	9
222	Admin Gen Purp	18,854	Fair	
7450*	Regimental HQ Bldg	9,850	Fair	
7636	Regimental HQ Bldg	9,850	Fair	
7033	Bn Hqt Building	4,083	Fair	
7866*	Theater w/ Dressing Rm.	11,098	Fair	
7834	Regimental HQ Bldg	9,904	Good	
8065	Clinic W/O Beds	3,848	Poor	
8067	Exchange Branch	4,850	Poor	
7520	Veh Mnt Shop Org	27,112	Good	9
7600	Veh Mnt Shop Org	17,163	Good	9
7780	Veh Mnt Shop Org	17,163	Good	9
7900	Veh Mnt Shop Org	20,943	Good	9
7940	Veh Mnt Shop Org	22,405	Good	9
301*	Finance Admininistration	32,947	Poor	
302	Finance Admininistration	16,138	Poor	
319	General Instruction Bldg	9,690	Poor	
8410	Veh Mnt Shop Org	73,233	Fair	
8330	Veh Mnt Shop Org	39,256	Fair	
8370	Veh Mnt Shop Org	26,876	Fair	
8380	Veh Mnt Shop Org	No Listing	Good	
7640	Exchange Branch	4,876	Poor	
7840	Exchange Branch	4,798	Good	
7410*	Bn Admin & Clrm	12,599	Fair	

1950	Salv & Surp Prop	42,480	Good
1980	Phys Fitness Center	24,968	Fair to Good
610	Enlisted Barracks W/AS	29,004	Good 1
7224	Enlisted Barracks W/AS	52,027	Fair
7230	Enlisted Barracks W/AS	52,027	Fair
7233	Enlisted Barracks W/AS	39,333	Fair
7305	App Instr Bldg	9,872	Fair
405*	Admin General Purpose	10,778	Poor
446	Off Open Dining	35,068	Fair 8
5800	Youth Center	No Listing	Good
6910	Exc Sp St Fac	2,525	Poor 9
7826	Clinic W/O Bed	3,841	Good
8021*	Adm & Support Building	23,676	Poor
8023	Adm & Support Building	23,676	Poor 4
8057	Adm & Support Building	23,676	Poor
8059	Adm & Support Building	23,676	Poor
512	Senior Enlisted Quarters	13,619	Poor 9
313	Civilian Personel Bldg	6,222	Fair
319	Civilian Personel Bldg	9,690	Fair
7602	Adm & Support Building	13,520	Fair
7608	Adm & Support Building	13,520	Fair
7652	Adm & Support Building	13,520	Fair
7658	Adm & Support Building	13,520	Fair
7802	Adm & Support Building	13,280	Fair
7808	Adm & Support Building	13,280	Fair
7852	Adm & Support Building	13,280	Fair
7858	Adm & Support Building	13,280	Fair
7432	Adm & Support Building	13,500	Fair
7264	Library Main	31,240	Fair
7626	Clinic W/O Beds	3,604	Fair
7826	Clinic W/O Beds	3,841	Fair
7086*	Unit Chapel	8,696	Poor to Fair
7865	Unit Chapel	8,718	Fair
7050	Enl Bk W/AS	39,675	Fair 9
7053	Enl Bk W/AS	39,675	Fair 9
403	Admin General (Design Prep)	18,151	Good 1
7034	Clinic W/O Beds	3,842	Fair
7739	Moving Target Sim Bldg	4,074	Poor
7044	Enl Bk W/O Din	52,027	Fair
7227	Enl Bk W/DAS	52,227	Fair
720	AF Ops Bldg	3,705	Fair
7031	Bn HQ Bldg	3,733	Fair
7046	Bn Classrooms	3,733	Fair
7604	Gen Inst Bldg	1,346	Good 6
7656*	Gen Inst Bldg	13,493	Good 6
5302*	Post Office	12,240	Fair
7245	Enlisted Personel Dine	13,998	Fair

214	Enlisted Barracks W/AS	35,821	Fair
227	Enlisted Barracks W/AS	32,303	Poor
7606*	Enlisted Persenel Dine	13,493	Fair
7654	Enlisted Persenel Dine	13,493	Fair
7804	Enlisted Persenel Dine	13,493	Fair
7854	Bn HQ Bldg	13,493	Fair
7856	Enlisted Persenel Dine	13,493	Fair
8010	Det Day Room	2,100	Poor
8046	Det Day Room	2,100	Poor
1470	AR Vehicle Maint. Shop	21,667	Fair
7212	Co. HQ Bldg	19,320	Good
7218	Bn. HQ Bldg	12,625	Good
7220	Co. HQ Bldg	18,870	Good
7048	Bn. HQ Bldg	2,604	Fair
7028	Bn Classrooms	3,733	Fair
7047	Bn. HQ Bldg	3,733	Fair
8008	Enlisted Barracks W/O Din	11,549	Poor
8014	Enlisted Barracks W/O Din	11,549	Poor
8040	Enlisted Barracks W/O Din	11,549	Poor
8048	Enlisted Barracks W/O Din	11,549	Poor
8050	Enlisted Barracks W/O Din	11,549	Poor
8054	Enlisted Barracks W/O Din	11,549	Poor
29	Red Cross Bldg	Not Government Owned	
6*	Post Chapel	6,230	Fair
3	Post Chapel	8,828	Fair
760	Bn HQ Bldg	7,364	Fair
727	Mnt Hangar Comb	36,152	Fair
509	Admin Gen Purpose	10,108	Good 9
8002*	Enlisted Barracks W/O Din	22,700	Poor
8006	Enlisted Barracks W/O Din	22,700	Poor
8012	Enlisted Barracks W/O Din	22,700	Poor
8020	Det Day Room	2,100	Poor
8038	Enlisted Barracks W/O Din	22,700	Poor
8042	Enlisted Barracks W/O Din	22,700	Poor
8052	Senior Enlisted Quarters	22,700	Poor
8056	Det Day Room	2,100	Poor
8044	Applied Inst Bldg	2,470	Poor
5000*	Fire Station	8,400	Very Poor
7610*	Enlisted Barracks W/AS	41,892	Fair to Good
7612	Enlisted Barracks W/AS	41,892	Fair to Good
7614	Enlisted Barracks W/AS	41,892	Fair to Good
7616	Enlisted Barracks W/AS	41,892	Fair to Good 9
7618	Enlisted Barracks W/O Din	41,892	Fair to Good 9
7642	Enlisted Barracks W/O Din	41,892	Fair 9
7644	Enlisted Barracks W/O Din	41,892	Fair 9
7646	Enlisted Barracks W/O Din	41,892	Good 9
7648	Enlisted Barracks W/O Din	41,892	Fair to Good 9

7650	Enlisted Barracks W/O Din	41,892	Good 9
7810	Enlisted Barracks W/O Din	41,843	Fair to Good
7812	Enlisted Barracks W/O Din	41,843	Fair to Good
7814	Enlisted Barracks W/O Din	41,843	Fair to Good
7816	Enlisted Barracks W/O Din	41,843	Fair to Good
7818	Enlisted Barracks W/O Din	41,843	Fair to Good
7842	Enlisted Barracks W/AS	41,843	Good
7844	Enlisted Barracks W/O Din	41,843	Good 1
7846	Enlisted Barracks W/AS	41,843	Good
7848	Enlisted Barracks W/O Din	41,843	Fair 1
7850	Enlisted Barracks W/AS	41,843	Good
7017	Bn HQ Bldg	2,604	Fair
7215	Bn HQ Bldg	2,604	Fair 9
540	Officers Quarters Military	14,528	Good 9
541	Officers Quarters Military	18,083	Good 9
542	Officers Quarters Military	14,528	Good 9
723	Mnt Hangar Comb	21,640	Fair
620	Officers Quarters Military	12,640	Good 1
621	Officers Quarters Trans.	10,723	Fair 2
27	Officers Quarters Military	38,146	Good 9
7036	Rgt Hqtr Building	10,010	Fair 9
5309	Guest House	23,784	Good

Total SF to be added: 4,569,457

Note 1 Under renovation/design
Note 2 FY 95 OMA Design List
Note 3 Possible CERL Project
Note 4 1 Oct 94 convert 3 Co. admin to 1 Bn HQTR/HVAC changes to supply area
Note 5 AAFES building
Note 6 Single loop digital controllers installed
Note 7 If very tight humidity & temp constraints are not maintained in these buildings thecontractor will shut computer equip. down and the Government is charged for all down time.
Note 8 I have been informed that the officers club has their own maintenance personnel and contractor.
Note 9 EMCS prepped
* = Typical Building

BUILDINGS THAT ARE NOW CONNECTED TO THE UEMCS

BUILDING	OCCUPANCY	SQUARE FT	EQUIP	QTY
184	Laundry Boiler Plant	1,959	FPU	1
203	Cavalry Museum	5,800	DSC REV C	1
205	Cavalry Museum	16,496	SLAVE	1
207	Cavalry Museum	8,278	DSC REV C	1
			SLAVE	2
211	Administrative	41,062	DSC REV C	1
253	Drug Abuse Center	11,122	DSC REV C	1
330	DEH Admin	14,913	FPU	1
364	UEMCS HQTRS	744	FPU	1
364	UEMCS HQTRS	744	DSC REV E	1
406*	CID BUILDING	10,390	DSC REV C	1
			SLAVE	1
615	IACH ENERGY PLT (FIBER OPT)	10,658	DSC REV E	2
615	IACH ENERGY PLT	10,658	DSC REV E	2
			SLAVE	5
650*	Cold Storage Facility	22,331	DSC REV C	1
652	Cold Storage Facility	8,167		
710	Tactial Equip Shop	2,173	DSC REV C	1
820	Tactial Equip Shop	20,564	DSC REV E	1
833	Aircraft Hanger	52,080	DSC REV C	1
			SLAVE	1
835	MAF Operations Building	19,470	DSC REV E	1
4010	Dental Clinic	15,587	DSC REV C	1
			SLAVE	1
5315	Morris Hill Chapel	19,748	DSC REV E	1
7210	CH Chiller Plant	4,320	DSC REV C	1
			SLAVE	1
8073	CH Energy Plant	4,070	FPU	7
8100	Consolidated Maintenance	224,927	FPU	6
8390	Tactial Equip Shop	24,755	DSC REV C	1
8300*	Veh Maint Shop Org	20,240	FPU	2
8320	Veh Maint Shop Org	20,240	FPU	2
8340	Veh Maint Shop Org	20,240	FPU	2
8360	Veh Maint Shop Org	39,428	FPU	3

Total area on existing EMCS = 651,164

Equipment Definitions;

FPU - Field Processing Unit

DSC - Digital System Controller (REV C - E)

Slave - Additional Field Interface Controller (FIC-101) without a processor (PCR-101) and a Control Display Board (CDB-101)

* = Typical Building

ANNEX B

REQUIRED DD FORM 1391 DATA

To facilitate ECIP project approval, the following supplemental data shall be provided:

a. In title block clearly identify projects as "ECIP."

b. Complete description of each item of work to be accomplished including quantity, square footage, etc.

c. A comprehensive list of buildings, zones, or areas including building numbers, square foot floor area, designated temporary or permanent, and usage (administration, patient treatment, etc.).

d. List references, and assumptions, and provide calculations to support dollar and energy savings, and indicate any added costs.

(1) If a specific building, zone, or area is used for sample calculations, identify building, zone or area, category, orientation, square footage, floor area, window and wall area for each exposure.

(2) Identify weather data source.

(3) Identify infiltration assumptions before and after improvements.

(4) Include source of expertise and demonstrate savings claimed. Identify any special or critical environmental conditions such as pressure relationships, exhaust or outside air quantities, temperatures, humidity, etc.

e. Claims for boiler efficiency improvements must identify data to support present properly adjusted boiler operation and future expected efficiency. If full replacement of boilers is indicated, explain rejection of alternatives such as replace burners, nonfunctioning controls, etc. Assessment of the complete existing installation is required to make accurate determinations of required retrofit actions.

f. Deleted

g. An ECIP life cycle cost analysis summary sheet as shown in the ECIP Guidance shall be provided for the complete project and for each discrete part included in the project. The SIR is applicable to all segments of the project. Supporting documentation consisting of basic engineering and economic calculations showing how savings were determined shall be included.

h. The DD Form 1391 face sheet shall include, for the complete project, the annual dollar and MBTU savings, SIR, simple amortization period and a statement attesting that all buildings and retrofit actions will be in active use throughout the amortization period.

i. The calendar year in which the cost was calculated shall be clearly shown on the DD Form 1391.

j. Deleted

k. Nonappropriated funded facilities will not be included in an ECIP project without an accompanying statement certifying that utility costs are not reimbursable.

l. Any requirements required by ECIP guidance dated 10 January 1994 and any revisions thereto. Note that unescalated costs/savings are to be used in the economic analyses.

m. The five digit category number for all ECIP projects except for Family Housing is 80000. The category code number for Family Housing projects is 71100.

ANNEX C

EXECUTIVE SUMMARY GUIDELINE

1. INTRODUCTION.

2. BUILDING DATA (types, number of similar buildings, sizes, etc.)

3. PRESENT ENERGY CONSUMPTION.

   o Total Annual Energy Used.

   o Source Energy Consumption.

   Electricity - KWH, Dollars, BTU
   Fuel Oil - GALS, Dollars, BTU
   Natural Gas - THERMS, Dollars, BTU
   Propane - GALS, Dollars, BTU
   Other - QTY, Dollars, BTU

   o Energy Consumption of the buildings in this study as compared to the basewide consumption.

4. HISTORICAL ENERGY CONSUMPTION.

5. REEVALUATED PROJECTS RESULTS.

6. ENERGY CONSERVATION ANALYSIS.

   o ECOs Investigated.

   o ECOs Recommended.

   o ECOs Rejected. (Provide economics or reasons)

   o ECIP Projects Developed. (Provide list)*

   o Non-ECIP Projects Developed. (Provide list)*

   o Operational or Policy Change Recommendations.

* Include the following data from the life cycle cost analysis summary sheet: the cost (construction plus SIOH), the annual energy savings (type and amount), the annual dollar

savings, the SIR, the simple payback period and the analysis date. For all programmed projects also include the year in which it is programmed and the programmed year cost.

7. <u>ENERGY AND COST SAVINGS.</u>

   o Total Potential Energy and Cost Savings.

   o Percentage of Energy Conserved.

   o Energy Use and Cost Before and After the Energy Conserv-tion Opportunities are Implemented.

8. <u>ENERGY PLAN.</u>

   o Project Breakouts with Total Cost and SIR.

   o Schedule of Energy Conservation Project Implementation

EMC
ENGINEERS, INC.

2750 South Wadsworth Blvd. • Suite C-200
Denver, Colorado 80227-3400
(303) 988-2951 • Fax: (303) 985-2527

24 August 1994

EMC #P13F-030

Mr. Bob Miller
ED-MF
US Army Corps of Engineers
Kansas City District
700 Federal Building
Kansas City, MO 64106-2896

Re: DACA 01-93-R-0148
Fort Riley HVAC Study

Dear Bob:

Enclosed is our fee proposal for the above referenced project. Our proposed fee is $99,091. Dividing the total fee by the number of buildings results in a unit cost of about $1400 per building. The fee is based on work defined by:

- Scope of Work dated 17 August 1994.

This fee is contingent on EMC performing the Ft. Riley UEMCS Study for which we have previously negotiated a fee.

The technical approach is divided into the following tasks with interface points with the UEMCS study noted:

1. A total of 70 buildings (approximately 30% of the buildings listed) will be evaluated for HVAC repair and replacement. The 70 buildings will be selected based on data collected during the UEMCS field survey in consultation with Fort Riley.

2. A detailed survey of each of the 70 buildings will be conducted by an HVAC design engineer for the purpose of collecting specific data regarding HVAC repair and replacement. Additional necessary plans will be pulled.

3. A written description of the HVAC system in each building will be prepared including an assessment of the existing condition and a tabulation of HVAC system parameters.

4. A cost estimate for restoring failed or failing HVAC systems to their intended operating condition will be prepared.

5. More efficient replacement HVAC systems will be identified and cost estimates for replacement of existing HVAC systems prepared.

6. Energy savings resulting from replacement of HVAC systems will be estimated through computer modeling of the existing and the proposed more efficient HVAC systems. The baseline models from the UEMCS study will be used as the baselines for the HVAC study. These baseline models will be modified to represent the proposed HVAC systems. Not all buildings will be modeled. Computer modeling will be limited to the approximately 20 modeled baselines of the UEMCS study. Results will be extrapolated to the remaining typical buildings. Only one replacement HVAC system will be evaluated per HVAC system.

7. A life cycle cost analysis will be performed for each building.

8. A written Interim Report will be prepared detailing the analysis and will be presented in an oral presentation at Fort Riley.

9. The Pre-Final Report will incorporate review comments from the Interim Report and will in addition contain Programming Documentation for repair or replacement projects selected by Fort Riley from the Interim Report. The Pre-Final Report will also include an oral presentation at Fort Riley.

10. The Final Report will incorporate all review comments from the Pre-Final Report.

11. The HVAC Study will be coordinated with the UEMCS Study such that UEMCS recommendations and costs will be applied to the most cost effective HVAC system. In other words, it will be assumed that the HVAC system will be repaired or replaced prior to installation of the UEMCS.

The following clarifications are made to the SOW:

1. Paragraph 2.4, the term "all ECOs" will apply only to HVAC system replacement. Only one replacement HVAC system will be evaluated for each existing HVAC system.

2. Paragraph 3.4, meetings at Fort Riley will be limited to those scheduled including kickoff meeting, exit interview, review conferences, and presentations. Telephone conferences will be scheduled whenever requested.

In developing the fee proposal, we allocated the following hours to each building:

Task	Manhours
Field Survey	2
Description/Deficiency Tabulation	1
HVAC System Data Tabulation	1
Repair Cost Estimate	3
Replacement System Description	1
Energy Savings Calculations	3
Replacement Cost Estimate	4
Life Cycle Cost Analysis	1
Total	16

We feel that 16 hours is the minimum time required per building to provide the required level of detail. The report will be organized by building and will provide sufficient detail for the designer to design an energy efficient system which can be installed for the indicated cost.

Please give me a call if you have any questions.

Sincerely,

E M C ENGINEERS, INC.

Dennis Jones

APPENDIX B

CONFIRMATION NOTICES AND CORRESPONDENCE

CONFIRMATION NOTICE

Confirmation No. 2 EMC #1406-005

DATE:	November 22, 1994
PROJECT:	Feasibility Study for HVAC Upgrade Fort Riley, Kansas
CONTRACT No.:	DACA 01-93-D-0033
NOTES PREPARED BY:	Alan Niemeyer E M C Engineers, Inc.
DATE OF CONFERENCE:	8 November 1994
PLACE OF CONFERENCE:	Ft. Riley, Kansas
SUBJECT:	Entrance Interview

ATTENDEES:	Steve Fief	PW HVAC	913-239-6315
	Keith Jevons	PW Design	913-239-2044
	Jayce Krause	PW HVAC	913-239-6315
	Larry Stillwagon	PW Energy	913-239-2371
	Ken Williams	PW Energy	913-239-8188
	Alan Niemeyer	EMC Engineers, Inc.	303-988-2951

The following is a summary of the items discussed, the comments and decisions made during the interview.

1. Alan Niemeyer opened the meeting and introductions of those attending were made.

2. Alan Niemeyer stated that the purpose of the HVAC Upgrade Study is to identify and evaluate repair and replacement of failed or failing HVAC equipment. A total of 70 buildings will be evaluated. These buildings were selected from building lists provided by Public Works Energy Branch and from EMC Engineers UMCS field survey information.

3. The replacement of existing HVAC systems with more efficient HVAC systems was discussed. Alan Niemeyer explained that Multizone AHUs and Dual Duct AHUs can be upgraded to VAV AHUs. Larry Stillwagon stated that the HVAC system upgrades should be basic HVAC system designs, and not complicated HVAC systems with highly specialized components. Also, Larry stated that VAV upgrade systems should be considered for those Multizone and Dual Duct AHUs where the cooling coils are the chilled water type coil. Multizone and Dual Duct AHUs with DX cooling coils should not be considered for a VAV upgrade system, as variable air volume across a DX coil can cause the coil to freeze up. A HVAC upgrade system that includes variable

temperature with variable air volume to the space and a constant air volume fan could be considered for AHUs with DX coils.

4. Alan Niemeyer indicated that some of the HVAC systems to be upgraded should be replaced with new HVAC systems of the same type and design. These HVAC systems include Single Zone AHUs, Heating and Ventilating Units, Fan Coil Units, and Residential Furnaces.

5. Other HVAC systems discussed included Unit Heaters, Window AC Units, and Perimeter Radiation. Alan Niemeyer indicated that Unit Heaters should be replaced with Infrared Radiant Heaters where possible. Larry Stillwagon explained that a 30% energy savings could be attained by using Infrared Radiant Heaters compared to using Unit Heaters. Alan Niemeyer stated that Window AC Units could be replaced by fan coil systems, packaged terminal air conditioning units (PTACs), or central air systems depending on the building layout and use. Air-to-Air Heat Pumps will not be considered for replacement of Window AC Units per discussion at the meeting. Alan Niemeyer explained that Perimeter Radiation could be upgraded with radiator control valves. Jayce Krause indicated that the condition of the radiation system piping should be considered, as some of the pipe is old, worn, and corroded. Installing new control valves on an old piping system could become very costly, as additional lengths of new pipe may be needed if existing pipe is too worn or corroded to connect up to.

6. HVAC system replacement was discussed for the "rolling pin" style barracks in the 7000 series area buildings. Existing fan coils in these barracks could be replaced with Multizone AHUs if proper clearance for installation of ductwork is available in the hallways.

7. HVAC system replacement was discussed for the barracks in the 8000 series area buildings. A design for replacement of existing fan coils is currently underway for some of these barracks. Keith Jevons stated that EMC Engineers should review the design for these replacement systems as a part of the HVAC Upgrade Study to advise if a more energy efficient system should be considered for the design.

8. The discussion of Unit Heaters for replacement with Infrared Radiant Heaters brought up the fact that the Motor Pool buildings (Buildings 7173, 7174, 7175, 7176, and 7178) were not included in either the HVAC Upgrade Study or the UMCS Study. These buildings are prime candidates for this type of HVAC system upgrade. Alan Niemeyer agreed to include buildings 7176 and 7178 in both studies. The list of buildings in the Scope of Work for the UMCS Study contained two buildings which were duplicated. Adding the two Motor Pool buildings will offset the duplication. The list of buildings for the HVAC Upgrade Study was adjusted to include the Motor Pool buildings, for a total of 70 buildings for evaluation.

9. Larry Stillwagon stated that the age of some of the buildings at Ft. Riley should be considered when evaluating some of the HVAC systems for upgrade. Buildings that

become 50 years or older are classified as historical. A building classified as historical is subject to many limitations and restrictions where renovation is concerned. Depending on the type of building, it may be more cost effective to demolish old buildings that are about to be classified as historical, rather than to renovate and upgrade the HVAC systems. These types of buildings will be coordinated with Larry Stillwagon during the course of the HVAC Upgrade Study.

10. Alan Niemeyer asked about the preference on installation of actuators for dampers and control valves. Larry Stillwagon explained that if a pneumatic system is currently in place in a building, and upgrading a HVAC system would not require installing extensive quantities of pneumatic lines, then pneumatic actuators would be appropriate to use. Electric and electronic actuators should be considered in the HVAC upgrade evaluations, as they may be more cost effective for installation and use than pneumatic actuators.

11. Larry Stillwagon requested that part of the HVAC Upgrade Study could evaluate energy savings for upgrading existing Domestic Hot Water (DHW) systems to more efficient systems. He suggested two typical cases, where large quantities of DHW are required in buildings. The two typical cases would include: 1) a HW boiler used for space heat that is also used for DHW heat; 2) a dedicated boiler used to generate DHW.

12. Two government funding programs were discussed. The two programs are the Energy Conservation Investment Program (ECIP) and the Federal Energy Management Program (FEMP). The ECIP program will be used for the HVAC system replacement evaluation and the FEMP will be used for the HVAC system repair evaluation. If the proposed HVAC system upgrades do not qualify for either program, they will be considered for implementation through Operations and Maintenance funds at Ft. Riley.

13. Larry Stillwagon indicated that maintenance cost savings used in life cycle cost analyses should be taken from ASHRAE standards.

Alan Niemeyer

Alan Niemeyer
Project Manager

Copies To: Tony Battaglia
Keith Jevons
Bob Miller
Larry Stillwagon
EMC file

If any portion of this confirmation notice is incorrect, please notify us immediately. If correspondence is not received to the contrary within 14 days, it will be assumed that the decisions and conclusions, and status outlined in this confirmation notice is correct.

<u>CONFIRMATION NOTICE</u>

Confirmation No. 3 EMC #1406-005

DATE:	November 22, 1994
PROJECT:	Feasibility Study for HVAC Upgrade Fort Riley, Kansas
CONTRACT No.:	DACA 01-93-D-0033
NOTES PREPARED BY:	Alan Niemeyer E M C Engineers, Inc.
DATE OF CONFERENCE:	14 November 1994
PLACE OF CONFERENCE:	Ft. Riley, Kansas
SUBJECT:	Exit Interview

ATTENDEES:	Larry Stillwagon	PW Energy	913-239-2371
	Alan Niemeyer	EMC Engineers, Inc.	303-988-2951

The following is a summary of the items discussed, the comments and decisions made during the interview.

1. General field survey observations for HVAC upgrade repair were presented by Alan Niemeyer. Some air handling units were observed to have the following components in disrepair:

   - Damper actuators - missing or linkages disconnected
   - Fan Motors - noisy bearings
   - Fans - noisy bearings
   - Control valves - actuators dismantled or leak; valve bodies extremely rusty.

   Some pumps were observed to have the following components in disrepair:

   - Motors - noisy bearings
   - Pump seals - leaky

   Chillers and boilers were generally observed to be in fair condition.

2. General field survey observations for HVAC upgrade replacement were presented by Alan Niemeyer. Some air handling units were observed to be damaged with holes cut into the fan and duct casings, and rust/corrosion penetrating through fan and duct casings. Some pumps were observed to be rusted and corroded. Some boilers were observed to leaking from their interior, with rust and corrosion causing damage. The chillers were observed to be in fair condition, although some building managers interviewed said they had problems with their chillers shutting off during peak cooling load time periods. Age of the HVAC equipment was noted, to evaluate the remaining service life for equipment.

3. Alan Niemeyer indicated that building 8069 (swimming pool and gymnasium) had fair to good HVAC equipment and questioned why it was included on the HVAC upgrade list. Larry Stillwagon said this building has ventilation and humidity problems, and the HVAC systems should be evaluated for improving ventilation and reducing the humidity levels. Building 6940, also a swimming pool, should be evaluated for similar problems.

4. Alan Niemeyer requested a HVAC equipment listing from a computer data base at Ft. Riley, containing name plate data for the equipment. Larry Stillwagon said he would look into making the information available.

5. Alan Niemeyer requested a copy of the data transmission media (communication lines, telephone lines) drawings for the Main Post, Custer Hill, and Marshall Field areas. The drawings are not available in mylar or velum, so that blue print copies can be made. Larry Stillwagon said he would contact the DOIM office to make arrangements for the drawings to be copied.

Alan Niemeyer

Alan Niemeyer
Project Manager

Copies To: Tony Battaglia
Keith Jevons
Bob Miller
Larry Stillwagon
EMC file

If any portion of this confirmation notice is incorrect, please notify us immediately. If correspondence is not received to the contrary within 14 days, it will be assumed that the decisions and conclusions, and status outlined in this confirmation notice is correct.

EMC ENGINEERS, INC.

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Denver, Colorado 80227-3400
303/988-2951 • Fax: 303/985-2527

CONFIRMATION NOTICE

Confirmation Notice No. 4 EMC #1406.005

DATE: 1 May 1995

PROJECT: Feasibility Study for HVAC Upgrade, Fort Riley, Kansas
CONTRACT NO.: DACA 01-93-D-0033

NOTES PREPARED BY: Alan Niemeyer, E M C Engineers, Inc.

DATE OF MEETING: 27 April 1995

PLACE OF MEETING: Fort Riley, Kansas

SUBJECT: Interim Submittal Presentation and Review Conference

ATTENDEES:

David E. Werner	Kansas City District Corps of Engineers	(816) 426-2094
Robert S. Woodruff	Mobile District Corps of Engineers	(334) 694-4074
Keith R. Jevons	Public Works Design, Fort Riley	(913) 239-2044
Larry Stillwagon	Public Works Energy, Fort Riley	(913) 239-2371
Jack Olson	Public Works HVAC, Fort Riley	(913) 239-6315
Jayce Krause	Public Works HVAC, Fort Riley	(913) 239-6315
Dennis Jones	EMC Engineers, Inc.	(303) 988-2951
Alan Niemeyer	EMC Engineers, Inc.	(303) 988-2951

The presentation of the Interim Submittal for the Feasibility Study for HVAC Upgrade was given by Alan Niemeyer and Dennis Jones of EMC Engineers. The presentation included highlights from Sections 1 through 6, and a review of a typical proposed HVAC system replacement and typical HVAC system components for repair.

The Interim Submittal review comments were handed out to the meeting attendees.

Review comments were received for the Interim Submittal from the following organizations:

- Fort Riley Public Works Energy Branch
- HQ FORSCOM, Fort McPherson, GA
- USAED, Mobile, AL

The review comments were discussed and resolved during the course of the meeting. The responses to the review comments are as follows:

Comments from Larry Stillwagon, Fort Riley Public Works Energy Branch:

1. Comment #1. Annotation: CONCUR. Building 7612 currently has a dual temperature (DT) piping system. Heating and cooling coils, along with hot water and chilled water piping systems will be included in the proposed HVAC system description and cost estimate, instead of the DT piping system.

2. Comment #2. Annotation: CONCUR. Return air ductwork should be installed for the proposed VAV system in Building 7612, instead of a return air plenum. The main reason for not using a return air plenum is that existing electrical wiring and cable located within the proposed return air plenum is probably not rated for use inside an air plenum. (NFPA 90A 2-3.10.1 Plenums.)

3. Comment #3. Annotation: INFO. The VAV terminal units used in the cost estimate are constructed to meet proper sound level requirements in HVAC design (around 50 decibels). ASHRAE lists office air diffusers at sound levels around 50 decibels.

4. Comment #4. Annotation: CONCUR. The cost estimate will be changed to reflect 1/2 hour labor for demolition of each fan coil unit and 10 minutes labor for each 3-speed fan switch.

5. Comment #5. Annotation: CONCUR. I looked through our Scope of Work and could not find that asbestos removal was to be included in this study. The presence of suspect asbestos on the existing HVAC systems was noted as part of the Feasibility Study for Installation of UMCS.

   The cost for asbestos removal will be added to the construction costs for the proposed HVAC system replacements that qualify for ECIP funding. Information from the UMCS Study field survey and Asbestos Assessment Study by Hall Kimbrell Environmental Services will be used to develop costs for asbestos removal.

6. Comment #6. Annotation: CONCUR. Page numbers for the appendix sections will be included in the Prefinal Submittal. The field survey notes in Appendix E will be subdivided with building group tabs, similar to Section 4 and Appendix D. Also, Tables 5-1, 5-2, and 6-1 will be sorted by tab number and building number.

7. Comment #7. Annotation: INFO. The electrical kW demand dollar savings were not calculated correctly on the Life Cycle Cost Analysis (LCCA) sheets. The electrical kW demand was estimated from information provided by Steve Pientka, Public Works, Fort Riley. We used an estimated electrical kW demand of $4.20 per monthly kW. Because electrical kW is billed for using the highest peak kW reached during one month in a year, that electrical demand peak is billed for each month throughout the year. Our calculations omitted the total dollars saved for all the months in the year. We used $4.20 per monthly kW instead of $50.40 per annual kW (12 times the $4.20 per kW).

Comments from Linda Eslinger, Fort Riley Public Works Energy Branch:

8. Comment #1. Annotation: CONCUR. The electrical energy unit cost of $12.10 / Mbtu will be used on all LCCA calculation sheets. Also, we will use computer software, provided by Fort Riley Public Works Energy Branch, to calculate the electrical demand dollar savings for any summer peak electrical demand reductions.

Comments from Naresh K. Kapur, P.E., HQ FORSCOM, Fort McPherson, GA.:

9. Comment #1 Annotation: CONCUR. Comment is appreciated. Thank you.

10. Comment #2. Annotation: INFO. The construction costs were estimated using typical contractor markups of 16.8% for overhead and 10% for profit. This study assumes that a private contractor will be performing the construction work. At the study level or concept design level, a 20 percent contingency is typically used to cover unforeseen construction costs. The HVAC systems not qualifying for ECIP funding, may qualify for construction under O&M funding or another source of funding. The details of additional funding programs need to be discussed with Fort Riley Public Works personnel, especially who will be performing the construction work.

11. Comment #3. Annotation: INFO. This would not be necessary per discussions with HVAC Maintenance Shop and Public Works personnel.

12. Comment #4. Annotation: CONCUR. Overall energy savings, dollar savings, investment cost, simple payback, and SIR will be provided in Table ES-2 for the Prefinal Submittal.

13. Comment #5. Annotation: INFO. The three data sources used for selection of the 70 buildings are the information provided by Public Works Energy Branch,

Maintenance Shops, and the field survey from the UMCS Study. The condition of the existing HVAC systems, whether they were in good, fair, or poor condition, was the factor used in the selection.

The 70 buildings were selected from a list of 216 buildings. The 146 buildings, not included in this study, could also be evaluated as the 70 buildings in this study for an additional fee.

14. Comment #6. Annotation: INFO. The existing HVAC systems were evaluated for replacement with different types of HVAC systems that would meet the building design heating and cooling loads and operate more efficiently than existing HVAC systems. Changes in building use, from the original intended building use, were also included in the evaluation of HVAC system capacities for the proposed HVAC replacement systems.

15. Comment #7. Annotation: INFO. This would be good information for an overall basewide study, to compare these buildings with others. However, the scope of work for this energy study evaluates only a small percentage of buildings compared to the total number of buildings at Fort Riley. Additional information would be needed to state or make a comparison to other buildings at Fort Riley.

16. Comment #8. Annotation: DISAGREE. Table 2-1 is intended to provide general information about the building HVAC systems in the analysis. Section 4.0 provides an in-depth description and assessment of the HVAC systems on an individual building basis, including HVAC system sizes. It was agreed that the HVAC equipment types and sizes, presented in Section 4.0, are adequately represented.

17. Comment #9. Annotation: INFO. Visual observations were performed on cooling towers as part of the field survey. If rust, corrosion, or water scale build-up inside or on the cooling tower were visible, they were recorded on the field survey forms. The electric motors and tower fans were also visually observed.

18. Comment #10. Annotation: INFO. See Item No. 14, Comment #6.

19. Comment #11. Annotation: INFO. In Section 4, the Proposed HVAC System Replacement subsections are the ECO descriptions. Existing conditions of HVAC systems are described in the HVAC System Existing Conditions subsections. Per our Scope of Work, only one HVAC system replacement will be evaluated for an existing HVAC system. The source of energy and non-energy savings are discussed in the Method of Analysis subsections throughout Section 4. It was agreed that the format in Section 4.0 is adequate for describing the existing conditions and the proposed HVAC system replacements.

Generally, the existing ductwork will remain in place unless specifically mentioned that the existing ductwork would be replaced. When the construction costs for the proposed HVAC systems were estimated, new controls were included, as most of the existing controls are outdated and would not be appropriate for the proposed HVAC systems.

20. Comment #12. Annotation: INFO. In Section 4, under HVAC System Existing Conditions for each building, the year in which the building was built is provided. Most of the HVAC systems encountered were installed the same year the building was built. If a HVAC system was renovated, the year of renovation was included in the write-up. As far as information was available from design drawings and the field survey, sizes and capacities for HVAC equipment were provided in Section 4, HVAC System Existing Conditions write-ups.

    Additional information on HVAC equipment in the 70 buildings will be provided by adding the field survey forms from the Feasibility Study for Installation of UMCS to Appendix E.

21. Comment #13. Annotation: CONCUR. The wording in this section will be changed to provide clarity.

22. Comment #14. Annotation: INFO. For Building 7404, the electrical demand savings were entered as zero. The estimated electrical demand dollar savings for the proposed HVAC system were included in the rate for electrical energy dollar savings.

    The proposed HVAC system is the existing HVAC system that would be retrofitted, therefore nonrecurring costs were not included in the LCCA. The maintenance on the proposed HVAC system would not change significantly from the existing HVAC system, therefore maintenance savings were not included in the LCCA.

    Building 7404 is currently being renovated, and will not be included in the recommended HVAC system replacements for ECIP funding.

23. Comment #15. Annotation: INFO. See Item No. 10, Comment #2. Also, Fort Riley does not have in-house or troop construction capability.

24. Comment #16. Annotation: INFO. A walk-through of selected buildings before the meeting could be arranged, for anyone who is interested.

Comments from Robert S. Woodruff, EN-DM, Mobile District, AL.:

25. Comment #1. Annotation: DISAGREE. From observations during the field survey for the heat pump systems in Buildings 200, 500, and 509, the water treatment for the closed-circuit cooling towers appears to be in-place and working well. Leaks and failure of the pipe fittings in the condenser water system appear to be related to poor installation.

26. Comment #2. Annotation: CONCUR. The majority of the building is a single story building. The north end of the building has two stories which contain first and second floor offices. Write-up will be changed to provide clarity.

27. Comment #3. Annotation: DISAGREE. See Item No. 25, Comment #1.

28. Comment #4. Annotation: INFO. Per the Scope of Work, the proposed HVAC replacement systems were evaluated for energy savings. Repair and replacement of poor HVAC components does not result in significant energy savings, and would not qualify for ECIP funding.

29. Comment #5. Annotation: INFO. Some of the fan motors on the single zone air handlers have already been replaced with high efficiency motors. The policy at Fort Riley is to replace failed standard efficiency motors with high efficiency motors. The administration office areas in similar Administration and Supply buildings at Fort Riley have fan coil units that cycle the fans on and off for cooling. Also, the infiltration of outside air into the office areas is significant due to several door openings per hour and infiltration through operable windows. With cycling of the fan and the infiltration through doors and windows, occupants should receive adequate amounts of outside air.

30. Comment #6. Annotation: INFO. The controls for the single zone air handling units should be evaluated as part of the UMCS Feasibility Study.

31. Comment #7. Annotation: CONCUR. The boiler listed in the table should read "Fair condition" instead of "Poor condition".

32. Comment #8. Annotation: CONCUR. The HVAC System Components for Repair table should read 1-1/2" CW control valve instead of a 1" CW control valve. Correction will be made to the repair cost.

33. Comment #9. Annotation: INFO. The air volume is regulated by the VAV terminal unit controllers which are connected to the damper actuators and the existing zone

dampers. There are no VAV terminal units. Heating is accomplished by HW perimeter radiation throughout the building.

34. Comment #10. Annotation: INFO. Paragraph 4.30.3 on page 4-71 explains why Building 7053 was not considered for a HVAC system replacement. The fan coil units in Building 7814 provide both heating and cooling. The fan coil units in Building 7053 provide cooling only, heating is provided by HW perimeter radiation. The HW perimeter radiation is in fair condition and provides an excellent way to heat the building. Because the fan coil units are cooling-only, they are used for only five months during the year. A cooling-only VAV system to replace the fan coil units would cost over $200,000. The energy savings that would accrue from operation of the cooling-only VAV system vs the cooling-only fan coil units during a five month period would not be significant enough to pay for the installation of the cooling-only VAV system.

35. Comment #11. Annotation: CONCUR. The existing ductwork branches serve both the sanctuary and the basement areas. Both areas will have different heating and cooling loads, therefore VAV terminal units connected to the existing ductwork branches would not provide proper space temperature control. Additional ductwork and VAV terminal units will be included in the construction cost for the basement area, to make it a separate zone from the sanctuary.

36. Comment #12. Annotation: INFO. No. The heating profile of the kitchen space heating reflects the existing condition, and does not reflect the proposed heat recovery units. The kitchen space heating will be labeled as the existing condition.

37. Comment #13. Annotation: INFO. The title "Engineer's Opinion of Probable Cost" on the construction cost sheets is included as a legal protective measure and is recommended for use by our company insurance carrier.

38. Comment #14. Annotation: INFO. Maintenance does occur on the HVAC equipment at Fort Riley. Historical information on the hours required for maintenance and repair were not available. Typical maintenance and repair schedules for HVAC equipment types were assumed.

39. Comment #15. Annotation: INFO. Some of the field survey forms represent more than one piece of equipment. For instance, a building with several fan coil units has a field survey form that describes the general condition of all the fan coils, with specific notes for some of the fan coils. If a building has several air handlers or boilers that are identical and in the same condition, notes on a field survey form would describe the general condition of all, but would contain individual notes for a particular air handler or boiler describing a failed or failing condition.

For additional information for the 70 buildings in this study, the field survey forms from the Feasibility Study for Installation of UMCS will be included in Appendix E.

The project schedule was discussed. The date of 30 May 1995 was agreed upon for the next submittal, the Prefinal Submittal.

Packaging of the recommended HVAC system replacements for federal funding programs was discussed. Additional information is needed to determine which federal funding programs would be viable. EMC Engineers will provide a revised list of recommended HVAC system replacements to Larry Stillwagon. The recommended HVAC system replacements will reflect the changes discussed during this meeting, as stated in the review comments. This information will be provided to Larry Stillwagon by the 8th or 9th of May.

Larry Stillwagon will provide information concerning the packaging of the recommended HVAC system replacements for federal funding programs to EMC Engineers by May 15th.

Alan J. Niemeyer

Alan J. Niemeyer
Project Engineer, E M C Engineers, Inc.

Attachments: Written Government Comments

Action Required:

Recommended HVAC system replacements will be provided by EMC Engineers to Larry Stillwagon by the 8th or 9th of May;

Information will be provided by Larry Stillwagon for packaging the recommended HVAC system replacements for federal funding programs to EMC Engineers by May 15th.

cc:

David E. Werner	Robert S. Woodruff	Tony Battaglia	Naresh K. Kapur
Keith R. Jevons	Larry Stillwagon	Dennis Jones	File

If any portion of this Confirmation Notice is incorrect, please notify us immediately. If correspondence is not received to the contrary within 14 days, it will be assumed that the decisions, conclusions, and status outlined in this Confirmation Notice are correct.

FORT RILEY - PUBLIC WORKS
ENGINEERING REVIEW COMMENTS

TO: EMC ENGINEERS, INC.

Plans & Specifications / Design
__ Concept __ Final X Other (INT REPORT)
Designed by:
X A/E __ Dist __ DEH

PROJECT: HVAC UPGRADE STUDY

SUSPENSE DATE: ____

Comments by: Larry Stillwagon
Division: PW-EE
Date: 25 MAR 1995

REFERENCE	ITEM	COMMENT	ACTION
BLDG 7612 VAV	1	The VAV AHUs should have heating and cooling coils. The current policy is to provide heating and cooling to the occupants. Having heating and cooling available will allow heating during the night and cooling during the day in the spring and fall.	
BLDG 7612 VAV	2	Contrary to what I told you 24 Mar 95, there is no requirement to provide a return duct. The Corps reviewed the Codes again and could not find that using the area above a drop ceiling for the return was a violation (sorry about that).	
BLDG 7612 VAV	3	Please provide additional information on the VAV units. Are there any problems with noise or control when using a damper in a duct like your cost estimate indicates?	
BLDG 7612 VAV	4	Your demolition costs seem too low. I don't think that we could get anyone to remove the 92 FC units for $987. I also don't think that we will be able to get anything back for salvage on the pumps. I have the following comments on the demolition costs:	

FAN COIL DEMOLITION - If I assume that it takes 1/2 hour to remove each FCU, then the cost would be"

QTY	CREW	HOURS/UNIT	TOTAL
92	Q-5 *	.5	$3,122

* $67.86/hour from your labor cost

3-SPEED FAN SWITCH DEMOLITION - Using your labor cost for Q-5 of $67.86 shouldn't this cost be:

QTY	CREW	HOURS/UNIT	TOTAL
92	Q-5	.2	$1,249

FORT RILEY - PUBLIC WORKS
ENGINEERING REVIEW COMMENTS

TO: EMC ENGINEERS, INC.

Plans & Specifications / Design
___ Concept ___ Final _X Other (INT REPORT)
Designed by:
_X A/E ___ Dist ___ DEH

PROJECT: HVAC UPGRADE STUDY

SUSPENSE DATE: ______

Comments by: Larry Stillwagon
Division: PW-EE
Date: 25 MAR 1995

REFERENCE	ITEM	COMMENT	ACTION
BLDG 7612 VAV	5	The Corps is looking at a design to convert 7810 to VAV and they found Asbestos that had to be removed during the demolition (approx. $70,000). I don't see any mention of Asbestos in your field survey notes. The detailed Scope of Work states that you should indicate any conditions/deficiencies, and I would think that the presences of Asbestos which would effect the price/payback should be noted.	
General	6	I found it difficult to find some things in your Report. You need to number all pages, as required in your Scope of Work. And when you have information on several different buildings in a section, they should be in numerical order or further subdivided with tabs (ex, Field Survey Notes in APPENDIX E).	
General	7	We looked at the electrical savings in the calculation of the costs and payback calculations for the Bldg 7612 project and didn't see what you were talking about when you said that you only included one months usage. Please provide addional information or an example of what you are talking about.	

PW, FORT RILEY, KS
ENERGY SECTION

FACSIMILE TRANSMISSION COVER SHEET

TO: NAME: Alan Niemeyer

LOCATION: EMC Engineers, Inc.

FAX NO: 303-985-2527

DATE: 4 April 95

NUMBER OF PAGES (INCLUDING COVER PAGE): 1

FROM: NAME: Linda Eslinger

PHONE NO: 913-239-2371

FAX NO: 913-239-6678
CONFIRMATION NO: 913-239-2371

MESSAGE:

Alan,

Referring to Section 2.3.1 Electricity of the interim report; based on previous projects and experience we want you to use the Electrical Energy Unit Cost of $12.10/Mbtu for all Life Cycle Cost Analyses. If the project has a summer demand savings in electricity we estimate the savings to be $42.00/kW per year. This figure is based on our own calculations using a demand limiting spreadsheet. Any demand during the winter peak can be ignored for demand savings.

We were recently informed that we need a DA Form 1391 for some projects we are submitting for FEMP funding including the UMCS. We will produce the form but it would be helpful for us if you could send us information so we can break down the cost by line items. Whatever you used to get your estimate would be great. It will be understood this is only a preliminary estimate. Time is not critical, but if we could get this in a week or so it would help us. Thank You.

Linda Eslinger

If you have any questions, please call.

REVIEW COMMENTS FOR INTERIM SUBMITTAL :
FEASIBILITY STUDY FOR HVAC UPGRADE, FORT RILEY, KS

REVIEWER: NARESH K.KAPUR, P.E. DATED: 04 APR 95
ORGANIZATION: HQ FORSCOM
ADDRESS: ATTN: AFPI-ENO/KAPUR TEL: 404-669-5327, FAX -7751
BLDG. 200,
FORT MCPHERSON, GA 30330-6000

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1. THE INTERIM REPORT IS WELL ORGANIZED. EMC EXPERIENCE SHOWS-CONGRATULATIONS.
2. PG ES-2. LAST PARA `THE HVAC SYSTEMS NOT QUALIFYING FOR ECIP FUNDING PROGRAM WERE NOT RECOMMENDED FOR REPLACEMENT'. UNDER WHAT CIRCUMSTANCES WILL THESE BE COST EFFECTIVE. FOR EXAMPLE SELF HELP OR INHOUSE ACCOMPLISHMENT WHICH WOULD REDUCE THE COST SIGNIFICANTLY. PL REFER TO CMT 15.
3. TABLE ES-1 ON PG ES-3 IS VERY USEFUL FOR INSTALLATION TO FIX THE PROBLEM AREAS. IF POSSIBLE, MODIFY THE INFO IN THE TABLE SO THAT THE LOCATION OF EQUIPMENT CAN BE READILY IDENTIFIED.
4. TABLE ES-2, PG ES-5. PROVIDE OVERALL FIGURES FOR ENERGY SAVINGS (MBTU/YR), ENERGY DOLLAR SAVING ($/YR), TOTAL INVESTMENT ($), SIMPLE PAYBACK (YRS), AND SIR.
5. PARA 2.2 PG 2-1. ELABORATE THE FACTORS USED IN SELECTION OF 70 BUILDINGS OUT OF 216 BUILDINGS. WHAT ABOUT OTHER BUILDINGS? WHAT WOULD BE A REASONABLE WAY TO GENERATE ECOs FOR HVAC EQUIPMENT IN OTHER 156 BUILDINGS IF NEEDED?
6. PG 2-3. PARA BELOW TABLE 2-1. IS THE ENERGY EFFICIENT EQUIPMENT TO REPLACE THE EXISTING ONE OF OPTIMUM CAPACITY RATHER THAN SAME SIZE AS EXISTING ONE? PL DISCUSS.
7. TABLE 2-1. WHAT IS THE TOTAL AREA OF ALL THE SELECTED BUILDINGS? WHAT IS THIS AS A % OF TOTAL INSTALLATION AREA. THIS CAN BE GOOD INFO FOR EXECUTIVE SUMMARY.
8. IF POSSIBLE , PL MODIFY TABLE 2-1 TO INCLUDE SIZE OF EQUIPMENT ALONG WITH TYPE OF EQUIPMENT.
9. SECTION 3. WHAT KIND OF FIELD EVALUATION WAS DONE FOR THE COOLING TOWERS? USUALLY THESE POOR THINGS DO NOT GET MUCH ATTENTION UNTIL THEY STOP FUNCTIONING.
10. PARA 3.3.2 PG 3-2. THE HVAC EQUIPMENT SHOULD BE CHECKED FOR OVER-SIZING AND THEN PICK UP THE ENERGY EFFICIENT EQUIPMENT TO REPLACE IT.
11. GENERAL. IN SECTION 4, FOR EACH BUILDING, ESTABLISH A BRIEF ECO DESCRIPTION. IT SHOULD STATE CURRENT CONDITION, FUTURE CONDITION AFTER CONSIDERING VARIOUS OPTIONS, AND METHOD OF ACHIEVING THE CHANGE. MENTION SOURCE OF ENERGY SAVINGS AS WELL AS NON-ENERGY SAVINGS. REFER TO SKETCHES/PHOTOS, CATALOG CUT TYPE INFO AS APPROPRIATE. MENTIONING EFFICIENCIES AND SIZES OF EXISTING AND REPLACEMENT EQUIPMENT WOULD BE APPROPRIATE. MENTION IF THE EXISTING DUCT WORK (IF APPLICABLE) AND CONTROLS BE COMPATIBLE WITH REPLACEMENT EQUIPMENT. IF NOT, CONSIDER REPLACING THESE ITEMS ALSO TO ACHIEVE A BETTER OVERALL EFFICIENCY.

REVIEW COMMENTS FOR INTERIM SUBMITTAL :
FEASIBILITY STUDY FOR HVAC UPGRADE, FORT RILEY, KS

REVIEWER: NARESH K.KAPUR, P.E. DATED: 04 APR 95
ORGANIZATION: HQ FORSCOM
ADDRESS: ATTN: AFPI-ENO/KAPUR TEL: 404-669-5327, FAX -7751
BLDG 200,
FORT MCPHERSON, GA 30330-6000

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12. SECTION 4 GENERAL. UNDER `HVAC SYSTEM EXISTING CONDITIONS' FOR VARIOUS BUILDINGS, PROVIDE AGE/SIZES/CAPACITIES OF VARIOUS UNITS AS FAR AS POSSIBLE.
13. SEC 4.6.3 PG 4-12. PL ELABORATE AS TO HOW THE EXISTING HVAC SYSTEM IS EFFICIENT. QUANTIFY EFFICIENCY IN SUPPORT THIS AND SIMILAR STATEMENTS FOR OTHER BUILDINGS.
14. PG 4-51. PL VERIFY THE INFORMATION IN THE TABLE, ESPECIALLY DEMAND SAVINGS AND MAINTENANCE SAVINGS. ARE THERE ANY OTHER NON ENERGY SAVINGS POSSIBLE? CHECK APPENDIX D FOR LCCA FOR THIS BUILDING.
15. APPENDIX D - TAB 1 FOR BLDG 222. COST ESTIMATES HAVE THE FOLLOWING ADD ONS: OVERHEAD-17%, PROFIT_10%, CONTINGENCY-20% FOR A TOTAL OF 54.17% (CUMULATIVE). THE TOTAL COST INCLUDING THESE ADDONS APPEARS AS CONST COST IN 1A OF LCCA SUMMARY. THEN SIOH(5.5%) AND DESIGN COST (6%) ARE ADDED. THE FINAL COST IN 1G OF THE LCCA SUMMARY IS 71.9% ABOVE THE BASIC COST. IS THIS REASONABLE? THIS COMMENT APPLIES TO OTHER BUILDINGS. PL DISCUSS IN DETAIL. IN VIEW OF THIS, WHICH OF THE NON-RECOMMENDED ECOs WILL QUALIFY FOR INHOUSE OR TROOP CONSTRUCTION ACCOMPLISHMENT (WITH VERY LOW OVERHEADS).
16. WE SUGGEST A WALK THRU SOME SELECTED BUILDINGS BEFORE THE MTG. EMC IS REQUESTED TO SHOW US SOME OF THE TYPICAL HVAC EQUIPMENT FOR WHICH REPAIR AND/OR REPLACEMENT IS RECOMMENDED. THIS WILL GIVE US A BETTER PERSPECTIVE AS TO WHAT IS BEING DISCUSSED AT THE MEETING.

REILEY1.DOC

6 April 95

Post-It™ brand fax transmittal memo 7671

# of pages ▸ 2	
To ALAN NIEMEYER	From DAVID WERNER
Co. EMC ENGINEERS	Co. CEMRK-EP-DI Corps of Engineers
Dept.	Phone # 816 426 2397
Fax # 303 985-2527	Fax # 816 426 3690

As discussed

OPTIONAL FORM 99 (7-90)

FAX TRANSMITTAL

# of pages ▸ 2	
To Tony Battaglia	From Naresh Kapur
Dept./Agency Mobile Dist COE	Phone # 404-669-5327
Fax # 334-690-2424	Fax # -7751
Tel 2618	

NSN 7540-01-317-7368 5099-101 GENERAL SERVICES ADMINISTRATION

MOBILE DIST. OFFICE PROJECT REVIEW COMMENTS	DATE: 5 APR 95	PAGE 1 of 2
TO: Army Corps of Engineers Kansas City District	FROM: (Section): EN-DM (Reviewer): Robert S. Woodruff	
PROJECT: Feasibility Study for HVAC Upgrade LOCATION: FT. Riley, Kansas	Year:	Line Item No.:

Type of Action: Interim Report

Item No.	Drawing No. Or Par. No.	COMMENTS	Review Action
1.	Para 4.1.4 Page 4-3	Based on the problems presented in the report a comprehensive water treatment program should be recommended.	
2.	Bldg. 222 Report P. 4-4	This paragraph states that building 222 is a single story building with first and second floor offices ?	
3.	Bldg. 500 Report P. 4-11	Many of the problems associated with this heat pump system could be eliminated with a good water treatment program.	
4.	Bldg. 5000 Report P. 4-17	The designer should consider the economics of replacing only the components in bad condition.	
5.	Bldg. 7602 Report P. 4- 30	The second line of the top paragraph states that single zone air handlers will be replaced with more energy efficient single zone air handlers. Would it be more economical just to replace the existing blower motors with more efficient motors ? The new control sequence for the building calls for cycling the air handling units. Will an adequate amount of fresh air be supplied to the building occupants ? If cycling the new units is viable couldn't the existing units be cycled ?	
6.	Bldg. 7608 Report P. 4- 32	Could the existing units be cycled for a low cost energy savings ?	
7.	Bldg. 7658 Report P. 4-35	The table shows the boiler (BLR-1) in poor condition whereas paragraph 4.16.2 states that the boiler is in fair condition.	
8.	Bldg. 402 Report P. 4-44	The table in the center of the page shows AHU-3 with a 1-1/2" control valve whereas the table at the shows this same unit with a 1" control valve.	
9.	Bldg. 7404 Report P. 4-50	The proposed system presented in paragraph 4.23.3 needs clarification. If the air volume is regulated by the dampers at the converted multizone air handling unit why have VAV boxes also regulate the air volume ? If the hot deck of the air handling unit is blanked-off how is heating accomplished ?	
10.	Bldg. 7814 Bldg. 7053 P. 4-65 & P. 4-71	Buildings 7814 and 7053 appear to be very similar. They both are about the same age with similar mechanical systems. Building 7814 is recommended for HVAC replacement while building 7053 is not. This doesn't make sense.	

MOBILE DIST. OFFICE PROJECT REVIEW COMMENTS	**DATE:** 5 APR 95	**PAGE** 2 **of** 2
TO: Army Corps of Engineers Kansas City District	**FROM:** (Section): EN-DM (Reviewer): Robert S. Woodruff	
PROJECT: Feasibility Study for HVAC Upgrade **LOCATION:** FT. Riley, Kansas	**Year:**	**Line Item No.:**

Type of Action: Interim Report

Item No.	Drawing No. Or Par. No.	COMMENTS	Review Action
11.	Bldg. 3 P. 4-83	The zoning recommended in the first paragraph on page 4-83 doesn't sound logical. How can a basement and ground level area be served by the same VAV box?	
12.	Bldg. 7245 P. 4-100	A large amount of the energy used, as illustrated in the chart at the top of page 4-100, is used for kitchen space heating. Does this profile take into account the recommended heat recovery make up air units?	
13.	Vol. 2 App. C	The cost sheets are labeled as "Opinion." These estimates are surely more than opinions.	
14.	Vol. 2 App. D	The Maintenance Costs Assumptions for the Air Handling Units appear to be high. At most army installations they don't even look at an air handler unless it totally fails.	
15.	General	Why do the building studies in volume 1 contain more data about the items of equipment in each building than is shown in the field survey data ?	

PW, FORT RILEY, KS
ENERGY SECTION

FACSIMILE TRANSMISSION COVER SHEET

TO: NAME: Alan Niemeyer

LOCATION: EMC Engineers, Inc.

FAX NO: 303-985-2527

DATE: 12 May 95

NUMBER OF PAGES (INCLUDING COVER PAGE): 1

FROM: NAME: Linda Eslinger

PHONE NO: 913-239-2371

FAX NO: 913-239-6678
CONFIRMATION NO: 913-239-2371

MESSAGE:

Alan,

Here is the list of how Larry would like the HVAC projects grouped:

Group 1: 7665, 7670, 602 (Dental Clinics)

Group 2: 7245, 7606, 7654 (Dining Facilities)
Group all three projects for all three buildings together.

Group 3: 6940, 8069 (2 Pools)

Group 4: 7485 (Bowling Alley), 6620 (Activities Center - both projects)

Group 5: 7178 (Motor pool), 7806 (Bn Admin), 7086 (Chapel), 5000 (Fire Stn)

For the purposes of the EMCS Study, assume the projects for Groups 2 & 3 will be done by the time the EMCS is installed.

The rest of the projects can be finalized individually.

Linda Eslinger

BUILDINGS WITH SPECIAL CONSIDERATIONS
FOR HVAC REPAIR STUDY

Oct 5, 1994

NOTE 1: UNDER RENOVATION/DESIGN - ELIMINATE FROM LIST

223, 404, 610, 7844, 7848, 620 (BARRACKS) & 403 (ADMIN)

NOTE 2: FY 95 OMA DESIGN LIST - ELIMINATE FROM LIST

621, 409 (BARRACKS)

NOTE 3: CERL PROJECT - LEAVE ON LIST

7656 (TRAINING)

NOTE 4: 1 OCT 94 - CONVERT 3 CO ADMIN TO 1 BN HQTR/ HVAC CHANGES TO SUPPLY AREA - ELIMINATE FROM LIST

8023 (ADMIN)

NOTE 5: AAFES BUILDING - LEAVE ON LIST

6914 (MAIN EXCHANGE)

NOTE 6: SINGLE LOOP DIGITAL CONTROLLERS INSTALLED - ELIMINATE 7604 ONLY

7656, 7604 (TRAINING) & 7108, 7109 (ADMIN)

NOTE 7: IF VERY TIGHT HUMIDITY & TEMPERATURE CONSTRAINTS ARE NOT MAINTAINED IN THESE BUILDINGS, THE CONTRACTOR WILL SHUT THE COMPUTER EQUIPMENT DOWN AND THE GOVERNMENT IS CHARGED FOR ALL DOWN TIME - LOOK AT HVAC CLOSELY

722, 724 (BOTH FLIGHT SIMULATORS)

NOTE 8: EMCS PREPED BUILDINGS - FYI

LIST ENCLOSED

BUILDINGS TO INCLUDE IN HVAC EVALUATION Oct 17, 1994

One of These	8021 8023 8057 8059	ADMIN & SUPPORT BLDG
	7243	ADMIN & SUPPORT BLDG
	7602	ADMIN & SUPPORT BLDG
	500	POST HQ BLDG
	200	ADMIN GEN PURPOSE
	509	ADMIN GEN PURPOSE
One of These	7404 7424	ENL BARRACKS W/O DIN
One of These	7814 7810	ENL BARRACKS W/O DIN
One of These	8002 8006 8012 8038 8042	ENL BARRACKS W/O DIN
One of These	8008 8014 8040 8048 8050 8054	ENL BARRACKS W/O DIN
One of These	7612 7614	ENL BARRACKS W/AS
	402	ENL BARRACKS W/AS
One or All of These	409 410 411	ENL BARRACKS W/AS
	227	ENL BARRACKS W/AS
	540	OFF QTRS MIL
	7806	BN HQ BLDG
	3	ST. MARY'S CHAPEL
	7245	ENL PERS DIN

BUILDINGS TO INCLUDE IN HVAC EVALUATION

Oct 17, 1994

One of These	7606 7654	ENL PERS DIN
	741	MNT HANGAR COMB
	727	MNT HANGAR COMB
	7920	VEH MNT SHOP ORG
	202	KING FIELD HOUSE - GYM
	6914	MAIN POST EXCHANGE
	8069	INDOOR POOL - LONG GYM
	6940	INDOOR POOL - EYSTER
	6620	CUSTER HILL ACTIVITIES CENTER

POC: LINDA ESLINGER (913)239-2371/6841

UTILITY CONTROL SYSTEM PROJECT ADDITIONAL BUILDINGS CONDITIONS OF CONTROLS AND HVAC SYSTEMS

	BLDG	DESIGNATION	GROSS	UM	CONTROLS	CHILLER	Steam	BOILERS	Hot Water	AIR HANDLERS	FAN COILS
1	3	POST CHAPEL	8828	SF	FAIR	POOR	POOR			FAIR	
2	6	POST CHAPEL	8828	SF	FAIR	POOR		POOR			
3	27	OFF QTR MIL	38146	SF	GOOD		UNDER CONSTRUCTION				
4	23	RED CROSS BLDG	NOT GOVERNM	SF	FAIR	WINDOW A/C					
5	184	LAUNDRY BOILER PLANT	1959	SF	FAIR						
6	200	ADMIN GEN PURP	60690	SF	FAIR TO GOOD	GOOD		GOOD			
7	202	PHYS FIT CENTER	51307	SF	FAIR	WINDOW A/Cs		GOOD			
8	203	CAVALRY MUSEUM	5800	SF	RENOVATION	FAIR	GOOD			GOOD	
9	205	CAVALRY MUSEUM	16496	SF	RENOVATION	FAIR	SUPPLIED BY 203				
10	206	THEATER W/O DRESS RM	10754	SF	POOR		POOR			POOR	
11	207	CAVALRY MUSEUM	8278	SF	RENOVATION	FAIR			GOOD	GOOD	
12	210	MIL PERS BLDG	58446	SF	POOR	GOOD		GOOD		GOOD	
13	211	ADMINISTRATIVE	41062	SF	FAIR				GOOD		
14	214	ENL BK W/AS	35821	SF	FAIR		FAIR			FAIR	
15	222	ADMIN GEN PURP	18854	SF	FAIR	GOOD			GOOD	FAIR	
16	223	ENL BKS W/DAS	47794	SF	POOR			POOR		FAIR	
17	227	ENL BKS W/AS	32303	SF	POOR			GOOD		FAIR	
18	253	DRUG ABUSE CENTER	11122	SF	FAIR	FAIR	BOILER BEING REPLACED				
19	301	FIN ADMIN BLDG	32947	SF	POOR	GOOD		GOOD		GOOD	
20	302	FIN ADMIN BLDG	16138	SF	POOR	GOOD		FAIR			
21	313	CIV PERS BLDG	6222	SF	FAIR	FAIR		FA Furnace (FAIR)			
22	319	GEN INST BLDG	9690	SF	POOR	GOOD		GOOD		GOOD	
23	330	DEH ADMIN	14913	SF	FAIR	FAIR	FORCED AIR FURNACE				
24	364	EMCS HQTRS.	744	SF	FAIR		FORCED AIR FURNACE				
25	402	ENL BKS W/AS	35718	SF	POOR	POOR		GOOD		FAIR	
26	403	ADMIN GEN (DESIGN PR	18151	SF	GOOD	WINDOW A/C	GOOD				
27	404	ENL BKS W/DAS	35718	SF	POOR	POOR		GOOD		FAIR	
28	405	ADMIN GEN PURP	10778	SF	POOR	GOOD		FAIR			GOOD
29	406	CID BLDG.	10390	SF	FAIR	GOOD	GOOD			GOOD	
30	409	ENL BKS W/AS	32883	SF	POOR	POOR		GOOD		FAIR	
31	410	ENL BKS W/AS	32883	SF	POOR	POOR		GOOD		FAIR	
32	411	ENL BKS W/AS	32883	SF	POOR	POOR		FAIR		FAIR	
33	446	OFF OPEN DINING	35068	SF	FAIR	GOOD			GOOD	GOOD	
34	500	POST HQ BLDG	65453	SF	FAIR TO GOOD	GOOD		GOOD			GOOD
35	509	ADMIN GEN PURPOSE	10108	SF	GOOD						
36	512	SEN ENL QTRS	13619	SF	POOR	GOOD		GOOD			GOOD
37	540	OFF QTRS MIL	14528	SF	GOOD	GOOD		GOOD			GOOD
38	541	OFF QTRS MIL	18083	SF	GOOD	GOOD		GOOD			GOOD
39	542	OFF QTRS MIL	14528	SF	GOOD	GOOD		GOOD			GOOD
40	602	DENTAL CLINIC	11557	SF	FAIR	GOOD	GOOD			GOOD	
41	610	ENL BKS W/AS	29004	SF	FAIR TO GOOD	WINDOW A/Cs		BOILER PLANT			
42	615	IACH ENERGY PLANT	10658	SF	FAIR						
43	620	OFF QTRS MIL	12640	SF	FAIR TO GOOD	WINDOW A/Cs		BOILER PLANT			
44	621	OFF QTRS TRANS	10723	SF	FAIR TO GOOD	WINDOW A/Cs		BOILER PLANT			
45	650	COLD STORAGE FACILIT	22331	SF	FAIR		FURNACE GOOD				
46	652	COLD STORAGE FACILIT	8167	SF	FAIR		RADIANT HEATER GOOD				
47	710	TACTICAL EQUIP SHOP	2173	SF	FAIR	GOOD			GOOD		
48	720	AF OPS BLDG	3705	SF	FAIR		FORCED AIR FURNACES GOOD				
49	722	FLIGHT SIMULATOR	7000	SF	POOR	GOOD		GOOD			
50	723	MNT HANGAR COMB	21640	SF	FAIR		FAIR			POOR	
51	724	FLT SIM BLDG	13188	SF	GOOD	FAIR		FAIR			

? - A/C & Steam provided by 8073 Boiler Plant

\# A/C supplied by Chiller Plant 7210

UCS ADDITIONAL BUILDINGS CONDITION OF CONTROLS AND HVAC SYSTEMS

#	BLDG	DESIGNATION	GROSS	UM	CONTROLS	CHILLER	Steam-BOILERS-Hot Wtr	AIR HANDLERS	FAN COILS
52	727	MNT HANGER COMB	36172	SF	GOOD	WINDOW A/Cs	FAIR		
53	741	MAINT HANGAR COMB	38898	SF	FAIR		GOOD	POOR	
54	751	AC PTS & TOE ST	9834	SF	FAIR		GOOD		
55	760	BN HQTR BLDG	7364	SF	FAIR		BOILER BEING REPLACED		
56	802	BN ADMIN & CLRM	12526	SF	GOOD	SUPPLIED BY 806		GOOD	
57	804	RGT HQ BLDG	10241	SF	GOOD	SUPPLIED BY 806		GOOD	
58	806	COMB AC-HTG PLANT	1000	SF	GOOD	GOOD	GOOD		
59	808	BN ADMIN & CLRM	12526	SF	GOOD	SUPPLIED BY 806		GOOD	
60	810	ADM & SUP BLDG	15152	SF	GOOD	GOOD	GOOD	GOOD	GOOD
61	812	ADM & SUP BLDG	23559	SF	GOOD	GOOD	GOOD	GOOD	GOOD
62	814	MEDICAL FACILITY	NOT LISTED	SF	NEW	NEW	NEW		
63	817	MNT HANGAR AVUM	40061	SF	FAIR		GOOD		
64	820	VEH MNT SH ORG	20564	SF	GOOD	GOOD	GOOD	GOOD	GOOD
65	820	TACTICAL EQUIP SHOP	20564	SF	FAIR	FAIR	GOOD		
66	833	AIRCRAFT HANGER	52080	SF	FAIR	GOOD	GOOD	GOOD	
67	835	MAF OPERATIONS BLDG.	19470	SF	FAIR	SUPPLIED FROM 833		GOOD	
68	840	VEH MNT SH ORG	9152	SF	GOOD	GOOD	GOOD	GOOD	GOOD
69	853	MNT HANGAR AVUM	48112	SF	FAIR		GOOD		
70	1470	AR VEH MNT SHOP	21667	SF	FAIR	GOOD	GPPD	GOOD	
71	1950	SALV & SURP PROP	42480	SF	GOOD		FORCED AIR FURNACES GOOD		
72	1980	PHYS FITNESS CENTER	24968	SF	FAIR TO GOOD	GOOD	GOOD		
73	4010	DENTAL CLINIC	15587	SF	FAIR	GOOD		GOOD	
74	5000	FIRE STATION	8400	SF	FAIR	POOR	POOR	FAIR	
75	5302	POST OFFICE	12240	SF	FAIR	GOOD	GOOD	GOOD	
76	5309	GUEST HOUSE	23784	SF	FAIR	GOOD	GOOD	GOOD	
77	5315	MORRIS HILL CHAPEL	19748	SF	FAIR	GOOD		FAIR	FAIR
78	5800	YOUTH CENTER	NO LISTING	SF	GOOD	GOOD	GOOD	GOOD	
79	6620	COMMUN ACT CTR	31740	SF	FAIR	FAIR	GOOD	POOR	
80	6910	EXC SP ST FAC	2525	SF	POOR	GOOD	FORCED AIR FURNACES GOOD		
81	6914	EXC MAIN RETL	63830	SF	FAIR	POOR	FAIR	FAIR	
82	6918	SKILL DEV CEN	11507	SF	GOOD	GOOD			
83	6940	INDOOR SWIMMING POOL	23347	SF	POOR		GOOD	FAIR	
84	7004	ENL BKS W/DAS	39675	SF	FAIR	GOOD ‡	FAIR		POOR
85	7007	ENL BKS W/DAS	39675	SF	FAIR	GOOD ‡	FAIR	GOOD	POOR
86	7010	ENL BKS W/DAS	39675	SF	FAIR	GOOD ‡	FAIR	GOOD	POOR
87	7013	ENL BKS W/DAS	39675	SF	FAIR	GOOD ‡	FAIR	GOOD	POOR
88	7017	BN HQ BLDG	2604	SF	FAIR	GOOD	FORCED AIR FURNACES GOOD		
89	7024	GYMNASIUM	20619	SF	FAIR		GOOD	POOR	
90	7028	BN CLASSROOMS	3733	SF	FAIR	‡	POOR		
91	7031	BN HQ BLDG	3733	SF	FAIR	‡	GOOD		FAIR
92	7033	BN HQTR BLDG	4083	SF	FAIR	‡	FAIR	FAIR	
93	7034	CLINIC W/O BEDS	3842	SF	FAIR	‡	GOOD	GOOD	
94	7036	RGT HQTR BLDG	10010	SF	FAIR	‡	FAIR	GOOD	GOOD
95	7044	ENL BK W/O DIN	52027	SF	FAIR	‡	POOR	GOOD	
96	7046	BN CLASSROOMS	3733	SF	FAIR	‡	GOOD		GOOD
97	7047	BN HQ BLDG	3733	SF	FAIR	‡	GOOD		GOOD
98	7048	BN HQ BLDG	2604	SF	FAIR	‡	GOOD		GOOD
99	7050	ENL BK W/AS	39675	SF	FAIR	‡	GOOD		POOR
00	7053	ENL BK W/AS	39675	SF	FAIR	‡	FAIR		POOR
01	7055	BN HQ BLDG	2604	SF	FAIR	‡	FAIR	GOOD	
02	7065	UNIT CHAPEL	8696	SF	FAIR	GOOD	GOOD	GOOD	FAIR
03	7108	BN ADMIN & CLRM	12527	SF	GOOD	GOOD	GOOD	GOOD	
04	7109	BN ADMIN & CLRM	13535	SF	GOOD	GOOD	GOOD	GOOD	
05	7210	CH CHILLER PLANT	4320	SF	FAIR	GOOD			GOOD

? - A/C & Steam provided by 8073 Boiler Plant

‡ A/C supplied by Chiller Plant 7210

UCS ADDITIONAL BUILDINGS CONDITION OF CONTROLS AND HVAC SYSTEMS

#	BLDG	DESIGNATION	GROSS	UM	CONTROLS	CHILLER	Steam-BOILERS-Hot Wtr			AIR HANDLERS	FAN COILS
106	7212	CO HQ BLDG	19320	SF	GOOD	GOOD		GOOD		GOOD	GOOD
107	7215	BN HQ BLDG	2604	SF	FAIR	GOOD			FAIR	POOR	
108	7218	BN HQTR BLDG	12625	SF	GOOD	GOOD			GOOD	GOOD	
109	7220	CO HQ BLDG	18870	SF	GOOD	GOOD		GOOD		GOOD	GOOD
110	7224	ENL BK W/AS	52027	SF	FAIR	‡	POOR			GOOD	
111	7227	ENL BK W/DAS	52027	SF	FAIR	‡	POOR			GOOD	
112	7230	ENL BK W/AS	52027	SF	FAIR	‡	POOR			GOOD	
113	7233	ENL BK W/AS	39333	SF	FAIR	‡	POOR			GOOD	
114	7243	ADMIN & SUP BLDG	17829	SF	FAIR	‡			GOOD		GOOD
115	7245	ENL PERS DINE	13938	SF	FAIR :	GOOD ‡		GOOD		POOR	POOR
116	7253	FIN ADMIN BLDG	52400	SF	GOOD	WINDOW POOR		FAIR			
117	7264	LIBRARY	31240	SF	GOOD	FAIR		FAIR		FAIR	
118	7270	BN HQ BLDG	6130	SF	FAIR TO GOOD	GOOD		FAIR		GOOD	
119	7285	CLOTHING SALES	17042	SF	FAIR	FAIR			FAIR	FAIR	
120	7305	APP INSTR BLDG	9872	SF	FAIR	FAIR	FORCED AIR FURNACE				
121	7350	VEH MNT SH ORG	21345	SF	FAIR		CO-RAY VAC		FURNACES	FORCED AIR	
122	7404	ENL BK W/O DIN	50967	SF	FAIR	GOOD ‡		GOOD		FAIR	
123	7410	BN ADMIN & CLRM	12599	SF	FAIR	FAIR			GOOD	GOOD	
124	7424	ENL BK W/O DIN	50967	SF	FAIR	GOOD ‡		GOOD		FAIR	
125	7432	ADM & SUP BLDG	23016	SF	GOOD	GOOD		GOOD		GOOD	
126	7450	RGT HQ BLDG	9850	SF	FAIR	FAIR			FAIR	FAIR	FAIR
127	7485	BOWLING ALLEY	36966	SF	VERY POOR	FAIR			GOOD	FAIR	
128	7500	VEH MNT SH ORG	22325	SF	GOOD		CO-RAY VAC		FURNACES	FORCED AIR	
129	7520	VEH MN SH ORG	27112	SF	GOOD		CO-RAY VAC		FURNACES	FORCED AIR	
130	7602	ADMIN & SUP	13520	SF	FAIR	FAIR		FAIR			
131	7604	GEN INSTR BLDG	1346	SF	GOOD		BLDG BEING RENOVATED				
132	7506	ENL PERS DINE	13493	SF	FAIR	FAIR		POOR		POOR	
133	7608	ADMIN & SUF	13520	SF	FAIR	FAIR	FAIR			FAIR	
134	7610	ENL BK W/AS	41892	SF	FAIR TO GOOD	FAIR	POOR		FAIR	POOR	FAIR
135	7612	ENL BK W/AS	41892	SF	FAIR TO GOOD	FAIR	POOR		FAIR		FAIR
136	7614	ENL BK W/AS	41892	SF	FAIR TO GOOD	FAIR	POOR		FAIR		FAIR
137	7616	ENL BK W/AS	41892	SF	FAIR TO GOOD	FAIR	POOR		FAIR		FAIR
138	7518	ENL BK W/O DIN	41892	SF	FAIR TO GOOD	FAIR	POOR		FAIR	FAIR	
139	7620	BN ADMIN & CLRM	6340	SF	FAIR	FAIR			FAIR	FAIR	
140	7522	BN ADMIN & CLRM	12380	SF	FAIR	FAIR			FAIR	FAIR	
141	7624	BN ADMIN & CLRM	6158	SF	FAIR	FAIR			FAIR	FAIR	
142	7526	CLINIC W/O BEDS	3504	SF	GOOD	FAIR			POOR	POOR	
143	7630	BN ADMIN $ CLRM	6158	SF	FAIR	FAIR			FAIR	FAIR	
144	7632	GYMNASIUM	20694	SF	FAIR		FAIR			POOR	
145	7636	RGT HQ BLDG	9850	SF	FAIR TO GOOD	FAIR			FAIR	FAIR	FAIR
146	7638	BN ADMIN $ CLRM	6158	SF	FAIR	FAIR			FAIR	FAIR	
147	7640	EXCHANGE BRANCH	4876	SF	POOR	FAIR			FAIR	POOR	
148	7642	ENL BK W/O DIN	41892	SF	GOOD	FAIR	FAIR		FAIR	FAIR	
149	7644	ENL BK W/O DIN	41892	SF	FAIR	FAIR	FAIR		FAIR	FAIR	
150	7646	ENL BK W/O DIN	41892	SF	GOOD	FAIR	FAIR		FAIR	FAIR	
151	7648	ENL BK W/O DIN	41892	SF	FAIR TO GOOD	FAIR	FAIR		FAIR	FAIR	
152	7650	ENL BK W/O DIN	41892	SF	GOOD	FAIR	FAIR		FAIR	FAIR	
153	7652	ADM & SUP BLDG	13520	SF	GOOD	FAIR			POOR	POOR	
154	7654	ENL PERS DINE	13493	SF	FAIR	FAIR		POOR		POOR	
155	7654	ENL PERS DINE	13493	SF	FAIR	FAIR			POOR	POOR	
156	7656	GEN INST BLDG	13493	SF	GOOD	FAIR			FAIR	GOOD	
157	7658	ADM & SUP BLDG	13520	SF	GOOD	FAIR			POOR	POOR	
158	7665	DENTAL CLINIC	11076	SF	FAIR	FAIR	FAIR			GOOD	
159	7670	DENTAL CLINIC	14960	SF	FAIR	FAIR	GOOD			GOOD	

BP - A/C & Steam provided by 8073 Boiler Plant

‡ A/C supplied by Chiller Plant 7210

JCS ADDITIONAL BUILDINGS CONDITION OF CONTROLS AND HVAC SYSTEMS

#	BLDG	DESIGNATION	GROSS	UM	CONTROLS	CHILLER	Steam-BOILERS-Hot Wtr		AIR HANDLERS	FAN COILS
160	7720	VEH MNT SH ORG	22325	SF	GOOD		CO-RAY VAC	FURNACES FORCED AIR		
161	7739	TRGT MOV SIM BD	4074	SF	POOR	POOR		POOR	POOR	
162	7740	VEH MNT SH ORG	22325	SF	GOOD		CO-RAY VAC	FURNACES FORCED AIR		
163	7750	VEH MN SH ORG	17163	SF	GOOD		CO-RAY VAC	FURNACES FORCED AIR		
164	7760	VEH MN SH ORG	17163	SF	GOOD		CO-RAY VAC	FURNACES FORCED AIR		
165	7802	ADMIN & SUP	13280	SF	FAIR	FAIR		GOOD		FAIR
166	7804	ENL PERS DINE	13493	SF	FAIR	POOR	GOOD		POOR	
167	7806	BN HQ BLDG	13493	SF	FAIR TO GOOD	GOOD		GOOD	POOR	
168	7808	ADMIN & SUP	13280	SF	FAIR	FAIR		FAIR		FAIR
169	7810	ENL BK W/O DIN	41843	SF	FAIR TO GOOD	GOOD	POOR	GOOD		POOR
170	7812	ENL BK W/O DIN	41843	SF	FAIR TO GOOD	GOOD	POOR	GOOD		POOR
171	7814	ENL BK W/O DIN	41843	SF	FAIR TO GOOD	GOOD	POOR	GOOD		POOR
172	7816	ENL BK W/O DIN	41843	SF	FAIR TO GOOD	GOOD	POOR	GOOD		POOR
173	7818	ENL BK W/O DIN	41843	SF	FAIR TO GOOD	GOOD	POOR	GOOD	GOOD	
174	7820	BN ADMIN & CLRM	6673	SF	FAIR	FAIR		FAIR	FAIR	
175	7824	BN ADMIN & CLRM	12246	SF	FAIR	FAIR		FAIR	FAIR	
176	7826	CLINIC W/O BED	3841	SF	GOOD	FAIR		GOOD	FAIR	
177	7832	GYMNASIUM	20634	SF	FAIR			GOOD	POOR	
178	7834	RGT HQ BLDG	9904	SF	GOOD	POOR		GOOD	FAIR	
179	7836	BN ADMIN & CLRM	12246	SF	FAIR TO GOOD	GOOD		FAIR	FOOD	
180	7840	EXCHANGE BRANCH	4798	SF	GOOD	GOOD		FAIR	FAIR	
181	7842	ENL BK W/AS	41843	SF	GOOD	GOOD	POOR	GOOD	GOOD	
182	7844	ENL BK W/O DIN	41843	SF	GOOD	GOOD	GOOD	GOOD		POOR
183	7846	ENL BK W/AS	41843	SF	GOOD	GOOD	GOOD	GOOD	GOOD	
184	7848	ENL BK W/O DIN	41843	SF	FAIR TO GOOD	GOOD	POOR	POOR		POOR
185	7850	ENL BK W/AS	41843	SF	GOOD	GOOD	POOR	GOOD		GOOD
186	7852	ADMIN & SUP	13280	SF	FAIR	FAIR		GOOD		FAIR
187	7854	BN HQ BLDG	13493	SF	FAIR	GOOD	GOOD		POOR	
188	7856	ENL PERS DINE	13493	SF	FAIR	FAIR	GOOD		POOR	
189	7858	ADMIN & SUP	13280	SF	FAIR	FAIR		GOOD		FAIR
190	7865	UNIT CHAPEL	8718	SF	FAIR	POOR		FAIR	FAIR	
191	7866	THTR W/DRESS RM	11098	SF	FAIR	POOR	FAIR		POOR	
192	7900	VEH MN SH ORG	20943	SF	GOOD		CO-RAY VAC	FURNACES FORCED AIR		
193	7920	VEH MNT SH DS	124553	SF	FAIR		INFERRED HEATERS, FORCED AIR FURNACES			
194	7940	VEH MN SH ORG	22405	SF	GOOD		CO-RAY VAC	FURNACES FORCED AIR		
195	7950	VEH MNT SH ORG	20245	SF	GOOD		CO-RAY VAC	FURNACES FORCED AIR		
196	8002	ENL BK W/O DIN	22700	SF	POOR	BP	BP	FAIR-GOOD		FAIR
197	8006	ENL BK W/O DIN	22700	SF	POOR	BP	BP	FAIR-GOOD		FAIR
198	8008	ENL BK W/O DIN	11549	SF	POOR	BP	BP	FAIR-GOOD		FAIR
199	8010	DET DAY ROOM	2100	SF	POOR	BP	BP	N/A	FAIR	N/A
200	8012	ENL BK W/O DIN	22700	SF	POOR	BP	BP	GOOD		FAIR
201	8014	ENL BK W/O DIN	11549	SF	POOR	BP	BP	FAIR-GOOD		FAIR
202	8018	ENL BK W/O DIN	11549	SF	POOR	BP	BP	FAIR-GOOD		FAIR
203	8020	DET DAY ROOM	2100	SF	POOR	BP	BP	N/A	FAIR	N/A
204	8021	ADM & SUP BLDG	23675	SF	POOR	BP	BP	GOOD		FAIR
205	8023	ADM & SUP BLDG	23676	SF	POOR	BP	BP	GOOD		FAIR
206	8025	BN ADMIN & CLRM	12000	SF	POOR	BP	BP	FAIR-GOOD	GOOD	FAIR
207	8037	BN ADMIN & CLRM	12208	SF	POOR	BP	BP	FAIR-GOOD	GOOD	FAIR
208	8038	ENL BK W/O DIN	22700	SF	POOR	BP	BP	FAIR-GOOD		FAIR
209	8040	ENL BK W/O DIN	11549	SF	POOR	BP	BP	FAIR-GOOD		FAIR
210	8042	ENL BK W/O DIN	22700	SF	POOR	BP	BP	FAIR-GOOD		FAIR
211	8044	APPL INST BLDG	2470	SF	POOR	GOOD		GOOD		
212	8046	DET DAY ROOM	2100	SF	POOR	BP	BP	FAIR-GOOD	GOOD	
213	8048	ENL BK W/O DIN	11549	SF	POOR	BP	BP	FAIR-GOOD		FAIR

BP - A/C & Steam provided by 8073 Boiler Plant

* A/C supplied by Chiller Plant 7210

UCS ADDITIONAL BUILDINGS CONDITION OF CONTROLS AND HVAC SYSTEMS

#	BLDG	DESIGNATION	GROSS	UM	CONTROLS	CHILLER	Steam-BOILERS-Hot Wtr		AIR HANDLERS	FAN COILS
	8050	ENL BK W/O DIN	11549	SF	POOR	BP	BP	FAIR-GOOD		FAIR
2..	8052	SEN ENL QTRS	22700	SF	POOR	BP	BP	FAIR-GOOD		FAIR
216	8054	ENL BK W/O DIN	11549	SF	POOR	BP	BP	FAIR-GOOD		FAIR
217	8056	DET DAY ROOM	2100	SF	POOR	BP	BP	GOOD	GOOD	
218	8057	ADM & SUP BLDG	23676	SF	POOR	BP	BP	GOOD		FAIR
219	8059	ADM & SUP BLDG	23676	SF	POOR	BP	BP	NONE		FAIR
220	8063	ENL PERS DINE	18313	SF	POOR	BP	BP	GOOD	GOOD	
221	8065	CLINIC W/O BEDS	3848	SF	POOR	BP	BP	GOOD	GOOD	
222	8067	EXCHANGE BRANCH	4850	SF	POOR	BP	BP	POOR	FAIR	
223	8069	IN SW POOL/GYM	25620	SF	FAIR .					
224	8071	RGT HQ BLDG	9963	SF	POOR	BP	BP	NONE	GOOD	
225	8073	CH ENERGY PLANT	4070	SF	FAIR					
225	8100	CONSOLIDATED MAINTEN	224927	SF	FAIR	FAIR		FAIR	FAIR	
227	8300	VEH MNT SH ORG	20240	SF	FAIR		CO-RAY VAC	FURNACES FORCED AIR		
228	8320	VEH MNT SH ORG	20240	SF	FAIR		CO-RAY VAC	FURNACES FORCED AIR		
229	8330	VEH MNT SH ORG	39256	SF	FAIR	FAIR	GOOD	GOOD		
230	8340	VEH MNT SH ORG	20240	SF	FAIR		CO-RAY VAC	FURNACES FORCED AIR		
231	8350	VEH MNT SH ORG	20428	SF	FAIR		CO-RAY VAC	FURNACES FORCED AIR		
232	8370	VEH MNT SH ORG	25875	SF	FAIR		FORCED AIR FURNACES			
233	8380	VEH MNT SH ORG	NO LISTING	SF	GOOD					
234	8390	TACTICAL EQUIP SHOP	24755	SF	FAIR	FAIR		FAIR	GOOD	
235	8410	VEH MNT SH ORG	73233	SF	FAIR		PERFECTION HEAT, FURNACE FORCED AIR			

BP - A/C & Steam provided by 8073 Boiler Plant

* A/C supplied by Chiller Plant 7210

EMC
ENGINEERS, INC.

2750 South Wadsworth Blvd. • Suite C-200
Denver, Colorado 80227-3400
303/988-2951 • Fax: 303/985-2527

CONFIRMATION NOTICE

Confirmation Notice No. 5 EMC #1406.005

DATE: 1 August 1995

PROJECT: Feasibility Study for HVAC Upgrade, Fort Riley, Kansas
CONTRACT NO.: DACA 01-93-D-0033

NOTES PREPARED BY: Alan Niemeyer, E M C Engineers, Inc.

DATE REVIEW COMMENTS RECEIVED: 24 July 1995

DATE OF TELEPHONE CONVERSATION: 1 August 1995

SUBJECT: Prefinal Submittal Review Comments

REVIEW COMMENTS RECEIVED FROM:

Robert S. Woodruff Mobile District Corps of Engineers (334) 694-4074

No presentation and review conference were given for the Prefinal Submittal of Feasibility Study for HVAC Upgrade. The presentation and review conference were not given because of the small number of review comments received for this study.

The review comments received were discussed and resolved via a telephone call with Robert S. Woodruff. The responses to the review comments are as follows:

1. Comment #1. Annotation: CONCUR. The table ES-2 in the Executive Summary will be edited to include the totals for energy saved and energy dollars saved. The table 6-2 in Section 6, similar to table ES-2, will also be edited to include this information.

2. Comment #2. Annotation: DISAGREE. The condition of the HVAC equipment is contained on the HVAC Upgrade Observation survey forms in Vol. II FIELD SURVEY FORMS. These survey forms list the components on each of the HVAC

systems. For each of these components, the condition is designated either OK or a comment was written describing the damage or the repair and replacement required.

The overall condition of each of the HVAC systems was summed up and reported in Vol. I, Section 4. The overall condition for each of the HVAC systems was designated as either GOOD, FAIR, or POOR. If the condition of a HVAC system was POOR, the components which were damaged or in need of repair or replacement were reported.

Alan J. Niemeyer

Alan J. Niemeyer
Project Engineer, E M C Engineers, Inc.

Attachments: Reviewer Comments

Action Required: None

cc:

David E. Werner	Robert S. Woodruff	Tony Battaglia	Naresh K. Kapur
Keith R. Jevons	Larry Stillwagon	Dennis Jones	File

If any portion of this Confirmation Notice is incorrect, please notify us immediately. If correspondence is not received to the contrary within 14 days, it will be assumed that the decisions, conclusions, and status outlined in this Confirmation Notice are correct.

MOBILE DIST. OFFICE PROJECT REVIEW COMMENTS	DATE: 12 JUN 95	PAGE 1 of 1

TO: Army Corps of Engineers Kansas City District	FROM: (Section): EN-DM (Reviewer): Robert S. Woodruff

PROJECT: Feasibility Study for HVAC Upgrade LOCATION: FT. Riley, Kansas	Year:	Line Item No.:

Type of Action: Prefinal Report

Item No.	Drawing No. Or Par. No.	COMMENTS	Review Action
1.	Vol I. Exec. Summary	The table listing the recommended HVAC replacements should have the dollars saved and MBTU saved columns totaled. This enables readers to see the total results of this study.	
2.	Vol II. General	The condition of the various pieces of equipment is not contained in the field notes. This should be included as part of these notes.	

APPENDIX C

COST ESTIMATE FOR HVAC SYSTEM COMPONENTS FOR REPAIR

ENGINEER'S OPINION OF PROBABLE COST

PROJECT	Fort Riley Feasibility Study for HVAC Upgrade	SHEET	1 OF 8
ENGINEER	E M C Engineers, Inc. Denver, CO	DATE PREPARED	9-May-95
		ESTIMATOR	T. Poeling
		CHECKED BY	A. Niemeyer

Line No.	Item Refer Code	Item Description	Unit of Measure	MATERIAL COST Quantity	MATERIAL COST Unit Cost	MATERIAL COST Total	LABOR COST Crew/ Worker	LABOR COST Hours/ Unit	LABOR COST Total	TOTAL
1		**BUILDING 222 REPAIR**								
2	DMPACT	DAMPER ACTUATOR (INCL. DEMO)	EA.	1	$190.89	$191	1-STPI	1.5	$32	**$223**
3										
4		**BUILDING 302 REPAIR**								
5	FANBRG	FAN BEARING (INCL. DEMO)	EA.	1	$15.99	$16	Q-9	4	$75	**$91**
6										
7		**BUILDING 313 REPAIR**								
8	COIL	CONDENSER COIL (PLUS COVER)	EA	1	$545.06	$545	Q-5	13	$252	**$797**
9										
10		**BUILDING 8056 REPAIR**								
11	PMP3/4HP	PUMP, 3/4 HP, (INCL. DEMO)	EA.	1	$620.16	$620	Q-1	6.4	$124	**$744**
12										
13		**BUILDING 7636 REPAIR**								
14	CV2.5	CONTROL VALVE 2-1/2" (INCL. DEMO)	EA.	1	$935.09	$935	1-PLUM	5.334	$115	**$1,050**
15										
16		**BUILDING 7612 REPAIR**								
17	PSEAL	PUMP SEAL (INCL. DEMO)	EA.	1	$14.54	$15	Q-1	10	$194	**$208**
18										
19		**BUILDING 7614 REPAIR**								
20	PSEAL	PUMP SEAL (INCL. DEMO)	EA.	3	$14.54	$44	Q-1	10	$582	**$625**
21										
22		**BUILDING 7810 REPAIR**								
23	PSEAL	PUMP SEAL (INCL. DEMO)	EA.	2	$14.54	$29	Q-1	10	$388	**$417**
24										
25		**BUILDING 7814 REPAIR**								
26	PMP2HP	PUMP, 2 HP (INCL. DEMO)	EA	1	$867.26	$867	Q-1	7.4	$143	$1,011
27	PSEAL	PUMP SEAL (INCL. DEMO)	EA.	1	$14.54	$15	Q-1	10	$194	$208
28		**TOTAL - BUILDING 7814**								**$1,219**
29										
30		**BUILDING 8002 REPAIR**								
31	CV0.5	CONTROL VALVE 1/2" (INCL. DEMO)	EA.	12	$145.35	$1,744	1-PLUM	0.546	$141	$1,885
32	3SWTCH	3-SPEED FAN SWITCH	EA.	12	$14.54	$174	1-ELEC	0.667	$168	$342
33		**TOTAL - BUILDING 8002**								**$2,227**
34										
35										

ENGINEER'S OPINION OF PROBABLE COST

PROJECT	Fort Riley Feasibility Study for HVAC Upgrade	SHEET 2 OF 8	
		DATE PREPARED	9-May-95
ENGINEER	E M C Engineers, Inc. Denver, CO	ESTIMATOR	T. Poeling
		CHECKED BY	A. Niemeyer

Line No.	Item Refer Code	Item Description	Unit of Measure	MATERIAL COST			LABOR COST			TOTAL
				Quantity	Unit Cost	Total	Crew/ Worker	Hours/ Unit	Total	
1		**BUILDING 8012 REPAIR**								
2	CV0.5	CONTROL VALVE 1/2" (INCL. DEMO)	EA.	12	$145.35	$1,744	1-PLUM	0.546	$141	$1,885
3	3SWTCH	3-SPEED FAN SWITCH	EA.	12	$14.54	$174	1-ELEC	0.667	$168	$342
4		**TOTAL - BUILDING 8002**								**$2,227**
5										
6		**BUILDING 8038 REPAIR**								
7	CV0.5	CONTROL VALVE 1/2" (INCL. DEMO)	EA.	12	$145.35	$1,744	1-PLUM	0.546	$141	$1,885
8	3SWTCH	3-SPEED FAN SWITCH	EA.	12	$14.54	$174	1-ELEC	0.667	$168	$342
9		**TOTAL - BUILDING 8038**								**$2,227**
10										
11		**BUILDING 8042 REPAIR**								
12	CV0.5	CONTROL VALVE 1/2" (INCL. DEMO)	EA.	12	$145.35	$1,744	1-PLUM	0.546	$141	$1,885
13	3SWTCH	3-SPEED FAN SWITCH	EA.	12	$14.54	$174	1-ELEC	0.667	$168	$342
14		**TOTAL - BUILDING 8042**								**$2,227**
15										
16		**BUILDING 8052 REPAIR**								
17	CV0.5	CONTROL VALVE 1/2" (INCL. DEMO)	EA.	12	$145.35	$1,744	1-PLUM	0.546	$141	$1,885
18	3SWTCH	3-SPEED FAN SWITCH	EA.	12	$14.54	$174	1-ELEC	0.667	$168	$342
19		**TOTAL - BUILDING 8052**								**$2,227**
20										
21		**BUILDING 8014 REPAIR**								
22	CV0.5	CONTROL VALVE 1/2" (INCL. DEMO)	EA.	6	$145.35	$872	1-PLUM	0.546	$71	$943
23	3SWTCH	3-SPEED FAN SWITCH	EA.	6	$14.54	$87	1-ELEC	0.667	$84	$171
24		**TOTAL - BUILDING 8014**								**$1,114**
25										
26		**BUILDING 8040 REPAIR**								
27	CV0.5	CONTROL VALVE 1/2" (INCL. DEMO)	EA.	6	$145.35	$872	1-PLUM	0.546	$71	$943
28	3SWTCH	3-SPEED FAN SWITCH	EA.	6	$14.54	$87	1-ELEC	0.667	$84	$171
29		**TOTAL - BUILDING 8040**								**$1,114**
30										
31		**BUILDING 8048 REPAIR**								
32	CV0.5	CONTROL VALVE 1/2" (INCL. DEMO)	EA.	6	$145.35	$872	1-PLUM	0.546	$71	$943
33	3SWTCH	3-SPEED FAN SWITCH	EA.	6	$14.54	$87	1-ELEC	0.667	$84	$171
34		**TOTAL - BUILDING 8048**								**$1,114**
35										

ENGINEER'S OPINION OF PROBABLE COST

PROJECT	Fort Riley Feasibility Study for HVAC Upgrade	**SHEET**	3 OF 8
ENGINEER	E M C Engineers, Inc.	**DATE PREPARED**	9-May-95
	Denver, CO	**ESTIMATOR**	T. Poeling
		CHECKED BY	A. Niemeyer

Line No.	Item Refer Code	Item Description	Unit of Measure	MATERIAL COST Quantity	MATERIAL COST Unit Cost	MATERIAL COST Total	LABOR COST Crew/ Worker	LABOR COST Hours/ Unit	LABOR COST Total	TOTAL
1		**BUILDING 8050 REPAIR**								
2	CV0.5	CONTROL VALVE 1/2" (INCL. DEMO)	EA.	6	$145.35	$872	1-PLUM	0.546	$71	$943
3	3SWTCH	3-SPEED FAN SWITCH	EA.	6	$14.54	$87	1-ELEC	0.667	$84	$171
4		**TOTAL - BUILDING 8050**								**$1,114**
5										
6		**BUILDING 227 REPAIR**								
7	CV1	CONTROL VALVE 1" (INCL. DEMO)	EA.	1	$190.89	$191	1-PLUM	0.7065	$15	$206
8	CV1.5	CONTROL VALVE 1-1/2" (INCL. DEMO)	EA.	1	$276.17	$276	1-PLUM	1.0905	$23	$300
9		**TOTAL - BUILDING 227**								**$506**
10										
11		**BUILDING 402 REPAIR**								
12	CV1.5	CONTROL VALVE 1-1/2" (INCL. DEMO)	EA.	1	$276.17	$276	1-PLUM	1.0905	$23	**$300**
13										
14		**BUILDING 7245 REPAIR**								
15	CV2	CONTROL VALVE 2" (INCL. DEMO)	EA.	1	$397.29	$397	1-PLUM	1.3335	$29	$426
16	DMPACT	DAMPER ACTUATOR (INCL. DEMO)	EA.	2	$190.89	$382	1-STPI	1.5	$65	$446
17		**TOTAL - BUILDING 7245**								**$872**
18										
19		**BUILDING 7606 REPAIR**								
20	CV2	CONTROL VALVE 2" (INCL. DEMO)	EA.	2	$397.29	$795	1-PLUM	1.3335	$57	$852
21	PMP2HP	PUMP, 2 HP (INCL. DEMO)	EA	1	$867.26	$867	Q-1	7.4	$143	$1,011
22		**TOTAL - BUILDING 7606**								**$1,863**
23										
24		**BUILDING 7654 REPAIR**								
25	CV2	CONTROL VALVE 2" (INCL. DEMO)	EA.	1	$397.29	$397	1-PLUM	1.3335	$29	$426
26	DMPACT	DAMPER ACTUATOR (INCL. DEMO)	EA.	2	$190.89	$382	1-STPI	1.5	$65	$446
27		**TOTAL - BUILDING 7654**								**$872**
28										
29		**BUILDING 7804 REPAIR**								
30	DMPACT	DAMPER ACTUATOR (INCL. DEMO)	EA.	1	$190.89	$191	1-STPI	1.5	$32	**$223**
31										
32										
33										
34										
35										

ENGINEER'S OPINION OF PROBABLE COST

PROJECT	Fort Riley Feasibility Study for HVAC Upgrade	SHEET 4 OF 8	
		DATE PREPARED	9-May-95
ENGINEER	E M C Engineers, Inc.	ESTIMATOR	T. Poeling
	Denver, CO	CHECKED BY	A. Niemeyer

Line No.	Item Refer Code	Item Description	Unit of Measure	MATERIAL COST Quantity	MATERIAL COST Unit Cost	MATERIAL COST Total	LABOR COST Crew/ Worker	LABOR COST Hours/ Unit	LABOR COST Total	TOTAL
1		**BUILDING 7856 REPAIR**								
2	MTR1.5	FAN MOTOR, 1-1/2 HP	EA.	1	$193.80	$194	1-ELEC	2.667	$56	$250
3	MTR5	FAN MOTOR, 5 HP	EA.	1	$232.56	$233	1-ELEC	2.667	$56	$288
4	PATCH	PATCH DUCTWORK	JOB	1	$4.85	$5	1-SHEE	1	$21	$26
5		**TOTAL - BUILDING 7654**								**$564**
6										
7		**BUILDING 723 REPAIR**								
8	PSEAL	PUMP SEAL (INCL. DEMO)	EA.	4	$14.54	$58	Q-1	10	$776	$834
9	GASKET	CONDENSATE PUMP GASKET	EA.	8	$14.54	$116	1-PLUM	1	$172	$289
10	SHUTOFF	CONDENSATE SHUT-OFF CONTROLS	EA.	4	$58.14	$233	1-ELEC	1	$84	$316
11		**TOTAL - BUILDING 723**								**$1,439**
12										
13		**BUILDING 727 REPAIR**								
14	DMPACT	DAMPER ACTUATOR (INCL. DEMO)	EA.	1	$190.89	$191	1-STPI	1.5	$32	$223
15	PSEAL	PUMP SEAL (INCL. DEMO)	EA.	4	$14.54	$58	Q-1	10	$776	$834
16	GASKET	CONDENSATE PUMP GASKET	EA.	8	$14.54	$116	1-PLUM	1	$172	$289
17	SHUTOFF	CONDENSATE SHUT-OFF CONTROLS	EA.	4	$58.14	$233	1-ELEC	1	$84	$316
18	PMP1/3HP	PUMP MOTOR, 1/3 HP (INCL. DEMO)	EA.	1	$193.80	$194	1-ELEC	3.78	$79	$273
19		**TOTAL - BUILDING 727**								**$1,935**
20										
21		**BUILDING 8390 REPAIR**								
22	DMPACT	DAMPER ACTUATOR (INCL. DEMO)	EA.	1	$190.89	$191	1-STPI	1.5	$32	$223
23	CV1	CONTROL VALVE 1" (INCL. DEMO)	EA.	2	$190.89	$382	1-PLUM	0.7065	$30	$412
24	CV0.75	CONTROL VALVE 3/4" (INCL. DEMO)	EA.	8	$153.10	$1,225	1-PLUM	0.666	$115	$1,340
25		**TOTAL - BUILDING 8390**								**$1,975**
26										
27		**BUILDING 202 REPAIR**								
28	COIL	CONDENSER COIL (PLUS COVER)	EA	1	$726.75	$727	Q-5	13	$252	**$979**
29										
30		**BUILDING 6914 REPAIR**								
31	CV1.5	CONTROL VALVE 1-1/2" (INCL. DEMO)	EA.	1	$276.17	$276	1-PLUM	1.0905	$23	$300
32	CV2	CONTROL VALVE 2" (INCL. DEMO)	EA.	2	$397.29	$795	1-PLUM	1.3335	$57	$852
33	CV1.25	CONTROL VALVE 1-1/4" (INCL. DEMO)	EA.	2	$232.56	$465	1-PLUM	0.7995	$34	$500
34	DMPACT	DAMPER ACTUATOR (INCL. DEMO)	EA.	2	$190.89	$382	1-STPI	1.5	$65	$446
35		TOTAL - BUILDING 6914								$2,098

ENGINEER'S OPINION OF PROBABLE COST

PROJECT	Fort Riley Feasibility Study for HVAC Upgrade	**SHEET**	5 OF 8
ENGINEER	E M C Engineers, Inc.	**DATE PREPARED**	9-May-95
	Denver, CO	**ESTIMATOR**	T. Poeling
		CHECKED BY	A. Niemeyer

Line No.	Item Refer Code	Item Description	Unit of Measure	MATERIAL COST Quantity	MATERIAL COST Unit Cost	MATERIAL COST Total	LABOR COST Crew/ Worker	LABOR COST Hours/ Unit	LABOR COST Total	TOTAL
1		**BUILDING 7739 REPAIR**								
2	DMPACT	DAMPER ACTUATOR (INCL. DEMO)	EA.	4	$190.89	$764	1-STPI	1.5	$129	**$893**
3										
4		**BUILDING 6940 REPAIR**								
5	DMPACT	DAMPER ACTUATOR (INCL. DEMO)	EA.	1	$190.89	$191	1-STPI	1.5	$32	**$223**
6										
7		**BUILDING 6620 REPAIR**								
8	MTR7.5	FAN MOTOR, 7-1/2 HP	EA.	1	$329.46	$329	1-ELEC	2.8575	$60	$389
9	PSEAL	PUMP SEAL (INCL. DEMO)	EA.	2	$14.54	$29	Q-1	10	$388	$417
10		**TOTAL - BUILDING 6620**								**$806**
11										
12		**BUILDING 820 REPAIR**								
13	CV1.5	CONTROL VALVE 1-1/2" (INCL. DEMO)	EA.	2	$276.17	$552	1-PLUM	1.0905	$47	$599
14	PMP10HP	PUMP MOTOR, 10 HP (INCL. DEMO)	EA.	2	$455.43	$911	1-ELEC	4	$167	$1,078
15	PSEAL	PUMP SEAL (INCL. DEMO)	EA.	2	$14.54	$29	Q-1	10	$388	$417
16		**TOTAL - BUILDING 820**								**$2,094**
17										
18		**BUILDING 7485 REPAIR**								
19	VSD10	VARIABLE SPEED DRIVE W/ CONTRLER,10HP	EA.	1	$3,197.70	$3,198	1-ELEC	12.5	$262	**$3,459**
20										
21		**BUILDING 7602 REPAIR**								
22	CLGCOIL1	COOLING COIL, 2ROW, 30" x 30"	EA.	5	$494.19	$2,471	Q-5	6.25	$606	$3,077
23	STLPIP1.25	STEEL PIPE SCH. 40, 1.25" W/HANGERS	L.F.	90	$2.56	$230	Q-1	0.2	$349	$579
24	INSLPIP1.2	1.25" FIBERGLASS PIPE INSULATION, 1.5" THCK	L.F.	90	$1.40	$126	Q-14	0.08	$133	$258
25		**TOTAL - BUILDING 7602**								**$3,914**
26										
27		**BUILDING 7608 REPAIR**								
28	CLGCOIL1	COOLING COIL, 2ROW, 30" x 30"	EA.	5	$494.19	$2,471	Q-5	6.25	$606	$3,077
29	STLPIP1.25	STEEL PIPE SCH. 40, 1.25" W/HANGERS	L.F.	90	$2.56	$230	Q-1	0.2	$349	$579
30	INSLPIP1.2	1.25" FIBERGLASS PIPE INSULATION, 1.5" THCK	L.F.	90	$1.40	$126	Q-14	0.08	$133	$258
31		**TOTAL - BUILDING 7608**								**$3,914**
32										
33										
34										
35										

ENGINEER'S OPINION OF PROBABLE COST

PROJECT	Fort Riley Feasibility Study for HVAC Upgrade	**SHEET** 6 **OF** 8	
		DATE PREPARED	9-May-95
ENGINEER	E M C Engineers, Inc.	**ESTIMATOR**	T. Poeling
	Denver, CO	**CHECKED BY**	A. Niemeyer

Line No.	Item Refer Code	Item Description	Unit of Measure	MATERIAL COST Quantity	MATERIAL COST Unit Cost	MATERIAL COST Total	LABOR COST Crew/ Worker	LABOR COST Hours/ Unit	LABOR COST Total	TOTAL
1		**BUILDING 7652 REPAIR**								
2	CLGCOIL1	COOLING COIL, 2ROW, 30" x 30"	EA.	5	$494.19	$2,471	Q-5	6.25	$606	$3,077
3	STLPIP1.25	STEEL PIPE SCH. 40, 1.25" W/HANGERS	L.F.	90	$2.56	$230	Q-1	0.2	$349	$579
4	INSLPIP1.2	1.25" FIBERGLASS PIPE INSULATION, 1.5" THCK	L.F.	90	$1.40	$126	Q-14	0.08	$133	$258
5		**TOTAL - BUILDING 7652**								**$3,914**
6										
7		**BUILDING 7658 REPAIR**								
8	CLGCOIL1	COOLING COIL, 2ROW, 30" x 30"	EA.	5	$494.19	$2,471	Q-5	6.25	$606	$3,077
9	STLPIP1.25	STEEL PIPE SCH. 40, 1.25" W/HANGERS	L.F.	90	$2.56	$230	Q-1	0.2	$349	$579
10	INSLPIP1.2	1.25" FIBERGLASS PIPE INSULATION, 1.5" THCK	L.F.	90	$1.40	$126	Q-14	0.08	$133	$258
11		**TOTAL - BUILDING 7658**								**$3,914**
12										
13		**BUILDING 741 REPAIR**								
14	STMCOIL2	36X84 STEAM COIL (INCL. DEMO)	EA.	4	$896.33	$3,585	Q-5	17.913	$1,389	**$4,975**
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ENGINEER'S OPINION OF PROBABLE COST

PROJECT	Fort Riley Feasibility Study for HVAC Upgrade	SHEET 7 OF 8	
ENGINEER	E M C Engineers, Inc. Denver, CO	DATE PREPARED	9-May-95
		ESTIMATOR	T. Poeling
		CHECKED BY	A. Niemeyer

Line No.	Item Refer Code	Item Description	Unit of Measure	MATERIAL COST Quantity	MATERIAL COST Unit Cost	MATERIAL COST Total	LABOR COST Crew/ Worker	LABOR COST Hours/ Unit	LABOR COST Total	TOTAL
1		**SUMMARY - REPAIR COSTS**								
2		**BUILDING 222**								$223
3		**BUILDING 302**								$91
4		**BUILDING 313**								$797
5		**BUILDING 8056**								$744
6		**BUILDING 7636**								$1,050
7		**BUILDING 7612**								$208
8		**BUILDING 7614**								$625
9		**BUILDING 7810**								$417
10		**BUILDING 7814**								$1,219
11		**BUILDING 8002**								$2,227
12		**BUILDING 8012**								$2,227
13		**BUILDING 8038**								$2,227
14		**BUILDING 8042**								$2,227
15		**BUILDING 8052**								$2,227
16		**BUILDING 8014**								$1,114
17		**BUILDING 8040**								$1,114
18		**BUILDING 8048**								$1,114
19		**BUILDING 8050**								$1,114
20		**BUILDING 227**								$506
21		**BUILDING 402**								$300
22		**BUILDING 7245**								$872
23		**BUILDING 7606**								$1,863
24		**BUILDING 7654**								$872
25		**BUILDING 7804**								$223
26		**BUILDING 7856**								$564
27		**BUILDING 723**								$1,439
28		**BUILDING 727**								$1,935
29		**BUILDING 8390**								$1,975
30		**BUILDING 202**								$979
31		**BUILDING 6914**								$2,098
32		**BUILDING 7739**								$893
33		**BUILDING 6940**								$223
34										
35		**SUBTOTAL REPAIR COSTS**								$35,706

ENGINEER'S OPINION OF PROBABLE COST

PROJECT	Fort Riley Feasibility Study for HVAC Upgrade	SHEET 8 OF 8	
		DATE PREPARED	9-May-95
ENGINEER	E M C Engineers, Inc. Denver, CO	ESTIMATOR	T. Poeling
		CHECKED BY	A. Niemeyer

Line No.	Item Refer Code	Item Description	Unit of Measure	MATERIAL COST Quantity	MATERIAL COST Unit Cost	MATERIAL COST Total	LABOR COST Crew/ Worker	LABOR COST Hours/ Unit	LABOR COST Total	TOTAL
1		**SUMMARY - REPAIR COSTS (cont')**								
2		**BUILDING 6620**								**$806**
3		**BUILDING 820**								**$2,094**
4		**BUILDING 7485**								**$3,459**
5		**BUILDING 7602**								**$3,914**
6		**BUILDING 7608**								**$3,914**
7		**BUILDING 7652**								**$3,914**
8		**BUILDING 7658**								**$3,914**
9		**BUILDING 741**								**$4,975**
10										
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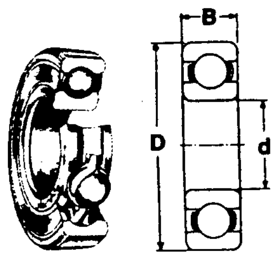
34										
35		**TOTAL REPAIR COSTS**								**$62,698**

ELECTRIC MOTOR GRADE BALL BEARINGS



NTN

CONTINUED ON NEXT PAGE

Ideal for motors, machine tools, generators, fans, pumps, power tools and appliances. Single row, deep groove bearings accommodate radial and thrust loads and can operate at very high speeds. Bearings are precision-made to exacting requirements and exceed rigid tolerances and running accuracies of ABEC-1 and AFBMA standards. Double shields and double seals in the popular 600, 6000, 6200, 6300 and "R" series bearings. Shielded bearings have two precision-fitted steel shields, sealed bearings have neoprene seals for protection from contaminants. All bearings are permanently lubricated for a long life of quiet operation with minimum friction. Bearings meet Military Specification MIL-G-19709A operation temperature range of −20 to +225°F. Each bearing is individually wrapped and cartoned to protect against contamination. NTN brand.

BEARING DIMENSIONAL DATA—DOUBLE SHIELDS OR DOUBLE SEALS

NTN Model	Bore (d) mm	Bore (d) Inches	Diameter (D) mm	Diameter (D) Inches	Width (B) mm	Width (B) Inches	NTN Model	Bore (d) mm	Bore (d) Inches	Diameter (D) mm	Diameter (D) Inches	Width (B) mm	Width (B) Inches
R6	—	.3750	—	.8750	—	.2812	6211	55	2.1654	100	3.9370	21	.8268
R8	—	.5000	—	1.1250	—	.3125	6212	60	2.3622	110	4.3307	22	.8661
R10	—	.6250	—	1.3750	—	.3438	6213	65	2.5591	120	4.7244	23	.9055
R12	—	.7500	—	1.6250	—	.4375	6214	70	2.7559	125	4.9213	24	.9449
R14	—	.8750	—	1.8750	—	.5000	6216	80	3.1496	140	5.5118	26	1.0236
R16	—	1.0000	—	2.0000	—	.5000	—	—	—	—	—	—	—
627	7	.2756	22	.8661	7	.2756	6303	17	.6693	47	1.8504	14	.5512
608	8	.3150	22	.8661	7	.2756	6304	20	.7874	52	2.0472	15	.5906
629	9	.3543	26	1.0236	8	.3150	6305	25	.9843	62	2.4409	17	.6693
6000	10	.3937	26	1.0236	8	.3150	6306	30	1.1811	72	2.8346	19	.7480
6001	12	.4724	28	1.1024	8	.3150	6307	35	1.3780	80	3.1496	21	.8268
6005	25	.9843	47	1.8504	12	.4724	6308	40	1.5748	90	3.5433	23	.9055
6200	10	.3937	30	1.1811	9	.3543	6309	45	1.7717	100	3.9370	25	.9843
6201	12	.4724	32	1.2598	10	.3937	6310	50	1.9685	110	4.3307	27	1.0630
6202	15	.5906	35	1.3780	11	.4331	6311	55	2.1654	120	4.7244	29	1.1417
6203	17	.6693	40	1.5748	12	.4724	6312	60	2.3622	130	5.1181	31	1.2205
6203**	†	.6250	40	1.5748	12	.4724	6313	65	2.5591	140	5.5118	33	1.2992
6204	20	.7874	47	1.8504	14	.5512	6314	70	2.7559	150	5.9055	35	1.3780
6205	25	.9842	52	2.0472	15	.5906	—	—	—	—	—	—	—
6206	30	1.1811	62	2.4409	16	.6299	6315	75	2.9528	160	6.2992	37	1.4567
6207	35	1.3780	72	2.8346	17	.6693	6316	80	3.1496	170	6.6929	39	1.5354
6208	40	1.5748	80	3.1496	18	.7087	6318	90	3.5433	190	7.4803	43	1.6929
6209	45	1.7716	85	3.3464	19	.7480	6319	95	3.7402	200	7.8740	45	1.7717
6210	50	1.9685	90	3.5433	20	.7874	6320	100	3.9370	215	8.4646	47	1.8504

SELECTION AND ORDERING INFORMATION

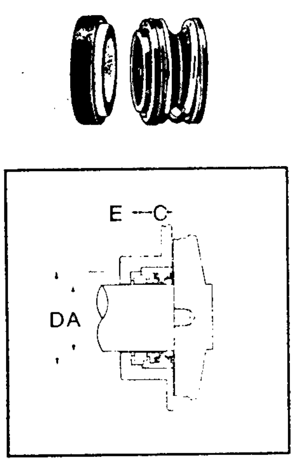
Fafnir	SKF	NSK	SNR	FAG	Koyo	NTN Model	Stock No.	List	Each	Shpg. Wt.
		NUMBERING INTERCHANGE								
SERIES R (EXTRA SMALL and EXTRA LIGHT) DOUBLE SHIELD										
S3KDD	—	R6ZZ	—	R6.2ZR	EE3SZZ	R6-ZZ	**1L004**	$15.07	**$7.72**	0.1
S5KDD	—	R8ZZ	—	R8.2ZR	EE4SZZ	R8-ZZ	**1L005**	15.86	**8.12**	0.1
S7KDD	—	R10ZZ	—	EE5.2ZR	EE5SZZ	R10-ZZ	**1L006**	18.23	**9.33**	0.1
S8KDD	—	R12ZZ	—	EE6.2ZR	EE6SZZ	R12-ZZ	**1L007**	21.62	**11.06**	0.1
S9KDD	—	R14ZZ	—	EE8.2ZR	EE8SZZ	R14-ZZ	**1L008**	24.66	**12.62**	0.2
S10KDD	—	R16ZZ	—	EE9.2ZR	EE9SZZ	R16-ZZ	**1L009**	28.87	**14.77**	0.1
SERIES R (EXTRA SMALL and EXTRA LIGHT) DOUBLE SEAL										
S3PP	—	R6VV	—	EE3.2RSR	EE3S2RS	R6-LL	**1L038**	22.41	**11.46**	0.1
S5PP	—	R8VV	—	EE4.2RSR	EE4S2RS	R8-LL	**1L039**	23.98	**12.27**	0.1
S7NPP	—	R10VV	—	EE5.2RSR	EE5S2RS	R10-LL	**1L040**	23.38	**11.96**	0.1
S8PP	—	R12VV	—	EE6.2RSR	EE6S2RS	R12-LL	**1L041**	26.80	**13.72**	0.2
N/A	—	R14VV	—	EE8.2RSR	EE8S2RS	R14-LL	**1L042**	31.39	**16.06**	0.2
S10PP2	—	R16VV	—	EE9.2RSR	EE9S2RS	R16-LL	**1L043**	33.46	**17.12**	0.2
SERIES 600 (SMALL) DOUBLE SHIELD										
38KDD	608-2Z	608ZZ	—	608.2ZR	608ZZ	608-ZZ	**1L001**	10.30	**5.27**	0.1
37KDD	627-2Z	627ZZ	—	627.2ZR	627ZZ	627-ZZ	**1L002**	10.00	**5.12**	0.1
39KDD	629-2Z	629ZZ	—	629.2ZR	629ZZ	629-ZZ	**1L003**	12.07	**6.18**	0.1
SERIES 600 (SMALL) DOUBLE SEAL										
38PP2	608-2RS	608VV	—	608.2RSR	608-2RS	608-LL	**1L035**	13.27	**6.79**	0.1
37PP2	627-2RS	627VV	—	627.2RSR	627-2RS	627-LL	**1L036**	18.53	**9.48**	0.1
39PP	629-2RS	629VV	—	629.2RSR	629-2RS	629-LL	**1L037**	18.19	**9.31**	0.1
SERIES 600 (EXTRA LIGHT) DOUBLE SHIELD										
9100KDD	6000-2Z	6000ZZ	6000ZZ	6000.2ZR	6000ZZ	6000-ZZ	**1L010**	14.17	**7.25**	0.
9101KDD	6001-2Z	6001ZZ	6001ZZ	6001.2ZR	6001ZZ	6001-ZZ	**1L011**	16.09	**8.23**	0.
9105KDD	6005-2Z	6005ZZ	6005ZZ	6005.2ZR	6005ZZ	6005-ZZ	**1L012**	22.78	**11.66**	0.

(**) 6203/15.875 (†) 15.875

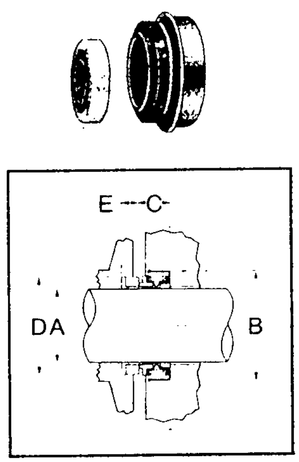
PUMPS: ACCESSORIES

JOHN CRANE PUMP SHAFT SEALS

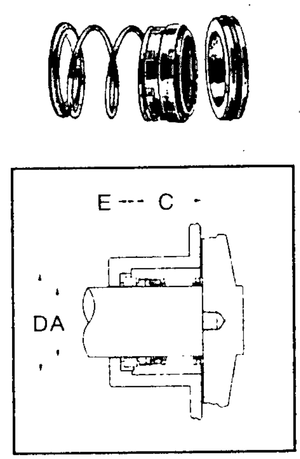
Type 6



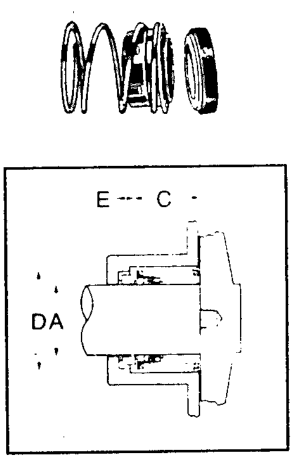
Type 6A



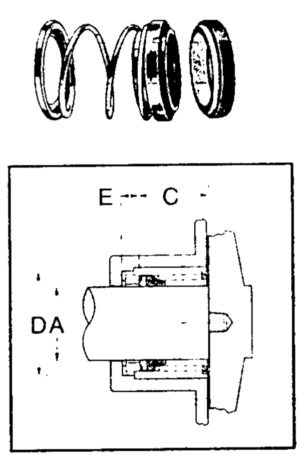
Type 1



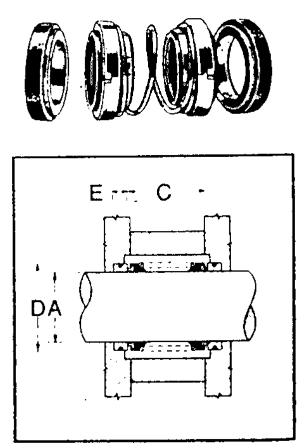
Type 2



Type 21



Type 21Dbl



Type 6—Elastomer bellows seal designed for use in small centrifugal water pumps, deep and shallow well jet pumps, and other positive displacement pumps. Full convolution elastomer bellows provides maximum flexibility in compensating for shaft movement and wear. Temperatures: −49 to 400°F. Pressures: Up to 75 PSIG. Speeds: Up to 1000 FPM or 3600 RPM.

Type 6A—Elastomer bellow seal for use in low pressure, small diameter rotary shaft applications. One piece construction allows for fast, easy production line installation by press fitting seal in equipment housing bore.

Type 1—Designed for use in pumps, mixers, blenders and other rotary shaft equipment. Can handle pressures to 425 PSIG and temperatures from −40 to 400°F. Can be field repaired to minimize costs, downtime and lost revenue.

Type 2—Designed for confined space requirements and limited gland depth in pumps, mixers and other rotary shaft equipment. Can handle temperatures of −40 to 400°F and pressures up to 425 PSIG.

Type 21—General purpose seal made of stainless steel. Can handle pressures up to 150 PSIG and temperatures of −40 to 400°F.

Type 21, Double Seal—Recommended where corrosives, sewerage type or abrasive liquids are being pumped. Liquid is circulated at 5 to 20 PSI pressure above the pressure against the inboard seal to create a sealing barrier.

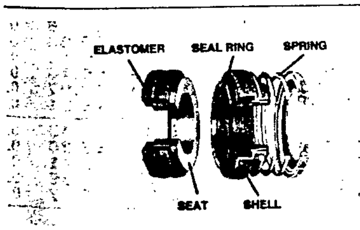
CONTINUED ON NEXT PAGE

JOHN CRANE PUMP SHAFT SEALS

REPLACEMENT SEAL SPECIFICATIONS AND ORDERING DATA

Seal Type	A Shaft Size	B Seal Bore	C Nominal Working Length	D Seat Bore	E Seat Thickness	Material Content Code	Stock No.	List	Each	Lots 6	Shpg. Wt.
6	5/8"	—	23/32"	1 3/16"	11/32"	BT2C1	5P403	$9.35	$6.12	$5.81	0.1
6	5/8	—	23/32	1 3/16	11/32	BT1C1	5P404	9.35	5.81	5.52	0.1
6	5/8	—	23/32	1 1/4	13/32	BT2C1	5P405	7.90	5.96	5.66	0.2
6	5/8	—	23/32	1 1/4	13/32	BT1C1	5P406	7.90	5.62	5.34	0.1
6	5/8	—	23/32	1 1/4	13/32	BF1C1	5P407	15.10	7.38	7.01	0.1
6	5/8	—	23/32	1 1/4	13/32	XF1C1	5P408	23.55	14.23	13.52	0.1
6	5/8	—	13/16	1 1/4	13/32	BT2C1	5P409	9.20	7.38	7.01	0.1
6	5/8	—	13/16	1 1/4	13/32	BT1C1	5P410	7.90	6.63	6.30	0.1
6	3/4	—	23/32	1 3/8	13/32	BT2C1	5P411	10.00	8.41	7.99	0.1
6	3/4	—	23/32	1 3/8	13/32	BT1C1	5P412	12.75	6.49	6.17	0.1
6	3/4	—	23/32	1 3/8	13/32	XF1C1	5P413	25.25	17.27	16.41	0.1
6	3/4	—	23/32	1 3/8	13/32	BF1C1	5P414	15.20	8.59	8.16	0.1
6	3/4	—	13/16	1 7/16	13/32	BT1C1	5P416	12.25	6.61	6.28	0.1
6	1	—	13/16	1 5/8	7/16	BT2C1	5P417	35.20	27.85	26.46	0.2
6A	5/8	1 7/16"	39/64	Shaft Mtd	7/32	BT171	5P402	10.20	4.72	4.48	0.1
6A	5/8	1 7/16	39/64	Shaft Mtd	7/32	XF171	5P365	32.55	19.91	18.91	0.1
6A	5/8	1 7/16	39/64	1 5/64	7/32	BT1C1	5P366	12.00	6.26	5.95	0.1
6A	5/8	1 7/16	39/64	1 3/16	11/32	BT2C1	5P367	29.70	23.76	22.57	0.1
6A	5/8	1 7/16	39/64	1 1/4	13/32	BT2C1	5P368	11.88	7.98	7.58	0.1
6A	5/8	1 7/16	39/64	1 1/4	13/32	BT1C1	5P369	11.88	9.45	8.98	0.1
1	1	—	1 9/16	1 5/8	7/16	BF2C1	5P370	56.16	31.30	29.74	0.2
1	1 1/16	—	1 19/32	1 3/4	13/32	BF2C1	5P371	169.73	135.80	129.01	0.3
1	1 1/8	—	1 3/16	1 3/4	7/16	BF271	5P372	141.08	72.10	68.50	0.3
1	1 1/8	—	1 5/8	1 3/4	7/16	BF2C1	5P373	84.65	80.40	76.38	0.3
1	1 1/4	—	1 5/8	1 7/8	7/16	BF2C1	5P374	116.20	100.50	95.48	0.3
1	1 7/16	—	1 11/16	2 1/16	7/16	BF2C1	5P375	190.75	152.75	145.11	0.3
1	1 5/8	—	2	2 5/16	1/2	BF271	5P376	172.70	138.20	131.29	0.6
1	1 5/8	—	2	2 5/16	1/2	BF2C1	5P377	184.97	138.20	131.29	0.5
1	1 3/4	—	2	2 1/2	1/2	BF2C1	5P378	171.22	125.05	118.80	0.5
1	2 1/16	—	2 3/8	2 7/8	9/16	BF271	5P379	531.30	241.50	229.43	0.8
2	1/2	—	13/16	1	5/16	BT2C1	5P380	22.28	17.82	16.93	0.1
2	5/8	—	7/8	1 1/4	3/8	BF2C1	5P381	24.85	19.89	18.90	0.2
2	5/8	—	7/8	1 1/4	13/32	BF2C1	5P382	19.14	15.31	14.54	0.1
2	3/4	—	7/8	1 3/8	13/32	BF2C1	5P383	20.07	17.05	16.20	0.2
2	1	—	1 1/16	1 5/8	7/16	BF2C1	5P423	55.90	44.70	42.47	0.2
2	1 1/8	—	1 1/16	1 3/4	7/16	BF871	5P424	96.80	77.45	73.58	0.3
2	1 1/8	—	1 1/16	1 3/4	7/16	BF2C1	5P425	93.15	74.50	70.78	0.3
2	1 1/4	—	1 1/16	1 7/8	7/16	BF2C1	5P426	82.40	60.80	57.76	0.3
21	1/2	—	13/16	1	5/16	BF1C1	5P418	13.80	11.04	10.49	0.1
21	9/16	—	27/32	1 1/32	5/16	BF141	5P419	14.35	11.45	10.88	0.1
21	5/8	—	23/32	1 1/4	13/32	BT1C1	5P420	14.80	11.84	11.25	0.1
21	5/8	—	1 3/16	1 5/32	5/16	BT1C1	5P421	11.25	8.98	8.53	0.1
21	5/8	—	7/8	1 1/4	3/8	BF1C1	5P422	19.30	15.45	14.68	0.1
21	5/8	—	7/8	1 1/4	13/32	BF1C1	5P384	11.22	11.13	10.57	0.1
21	5/8	—	7/8	1 1/4	13/32	BF1C1	5P385	11.20	11.13	10.57	0.1
21	5/8	—	7/8	1 1/4	13/32	BF1C1	5P386	11.22	11.13	10.57	0.1
21	5/8	—	1 21/64	1 9/64	5/16	BF1C1	5P387	16.60	8.91	8.46	0.1
21	3/4	—	7/8	1 3/8	13/32	BF1C1	5P389	35.15	11.88	11.29	0.1
21	3/4	—	7/8	1 3/8	13/32	XF1C1	5P388	21.30	17.05	16.20	0.1
21	1	—	1	1 5/8	7/16	BF1C1	5P390	51.60	32.95	31.30	0.2
21	1 1/8	—	1 1/16	1 3/4	7/16	BF1C1	5P391	73.90	16.17	15.36	0.2
21	1 1/8	—	1 1/16	1 3/4	7/16	BF171	5P392	75.90	53.20	50.54	0.3
21	1 1/8	—	1 1/16	1 3/4	7/16	BF171	5P393	101.95	57.20	54.34	0.3
21	1 1/4	—	1 1/16	1 7/8	7/16	BF1C1	5P394	76.23	18.46	17.54	0.1
21	1 1/4	—	1 3/8	1 7/8	7/16	BF1C1	5P395	88.05	52.80	50.16	0.3
21	1 1/4	—	1 1/16	1 7/8	7/16	BF171	5P396	79.40	61.80	58.71	0.3
21	1 3/8	—	1 1/8	2	7/16	BF1C1	5P397	96.60	71.20	67.64	0.1
21	1 1/2	—	1 1/8	2 1/8	7/16	BF1C1	5P398	118.50	65.95	62.65	0.3
21	1 3/4	—	1 3/8	2 1/2	1/2	BF171	5P399	219.30	81.80	77.71	0.7
21DBL	1 7/8	—	1 3/4	2 5/8	1/2	BF1C1	5P400	328.10	223.00	211.85	0.8
21DBL	2 3/4	—	3 3/4	3 1/2	5/8	BF171	5P401	467.00	373.75	355.06	2.2

(*) Material content is listed below with typical construction details.



MATERIAL CODE FOR SEALS

ELASTOMER
B=BUNA
X=VITON

SEAL RING
F=CARBON
T=MOLDED PLASTIC

HARDWARE OR SHELL
1=STAINLESS STEEL
2=BRASS

STATIONARY SEAT
C=CERAMIC
7=NI RESIST
4=BRONZE

SPRING
1=STAINLESS STEEL

SEE WARRANTY INFORMATION ON PAGE OPPOSITE INSIDE BACK COVER

APPENDIX D

PROPOSED HVAC SYSTEM REPLACEMENT CALCULATIONS

PREFACE TO APPENDIX D

The beginning portion of this Appendix contains the general backup data used in the HVAC system replacement calculations for all buildings evaluated. This data includes:

- Material and labor cost data tables.
- Maintenance cost data.
- Manufacturers literature and cost data.

Following the general backup data is the specific detailed backup for each building evaluated in this study.

MATERIAL & LABOR COST LOOK UP TABLE

PROJECT	Fort Riley Feasibility Study for HVAC Upgrade	**SHEET**	1 OF 6
ENGINEER	E M C Engineers, Inc.	**DATE PREPARED**	9-May-95
	Denver, CO	**PREPARED BY**	C. Wohlert
		CHECKED BY	A. Niemeyer

Line No.	Item Refer Code	Item Description	Unit of Measure	Material Average Cost	Location Adj. Cost 0.969	Labor Code	Labor Cost/Hr.	Labor Time (Hrs)	"Means" Line No.	"Means" Page No.
1	10"FLEX	10 IN. DIA. FLEX DUCT	L.F.	$3	$2.55	Q-9	$18.7	0.11	2020	254
2	10"VAVDP	10" VAV ROUND MOTORIZED DAMPER, ELEC	EA.	$311	$300.87	1-SHEE	$20.8	0.44	8516	286
3	12"RDUCT	12 IN. DIA. ROUND DUCT, GAL. STL	L.F.	$3	$2.73	Q-9	$18.7	0.13	5450	260
4	12X6SA	12X6 SA GRILLES	EA.	$10	$9.84	1-SHEE	$20.8	0.35	2020	278
5	14X6SA	14X6 RA GRILLES	EA.	$11	$10.85	1-SHEE	$20.8	0.35	1040	279
6	3SWTCH	3-SPEED FAN SWITCH	EA.	$15	$14.54	1-ELEC	$20.9	0.67	1700	E139
7	6"RDUCT	6 IN. DIA. ROUND DUCT, GAL. STL	L.F.	$1	$1.37	Q-9	$18.7	0.06	5420	260
8	8"RDUCT	8 IN. DIA. ROUND DUCT, GAL. STL	L.F.	$2	$1.79	Q-9	$18.7	0.08	5430	260
9	9X9DIFF	9X9 SA DIFFUSERS	EA.	$59	$56.69	1-SHEE	$20.8	0.57	2020	278
10	ACCU10	10 TON ACCU	EA.	$3,725	$3,609.53	Q-5	$19.4	32.00	600	252
11	ACCU15	15 TON ACCU	EA.	$5,350	$5,184.15	Q-5	$19.4	40.00	650	252
12	ACCU4	4 TON ACCU	EA.	$1,450	$1,405.05	Q-5	$19.4	17.78	400	252
13	ACCU5	5 TON ACCU	EA.	$1,775	$1,719.98	Q-5	$19.4	26.67	500	252
14	ACCU7.5	7.5 TON ACCU	EA.	$3,225	$3,125.03	Q-5	$19.4	29.09	550	252
15	ACTUAT	SMALL ELECTIRIC ACTUATOR	EA.	$100	$96.90	1-ELEC	$20.9	0.35	Estimated	
16	AHU10000	10,000 CFM AHU, COOLING ONLY	EA.	$4,975	$4,821	Q-6	$20.1	44.44	1550	234
17	AHU12000	12,000 CFM AHU, COOLING ONLY	EA.	$5,675	$5,499	Q-6	$20.1	52.17	1600	234
18	AHU1300	1,300 CFM AHU, COOLING ONLY	EA.	$1,975	$1,914	Q-5	$19.4	13.33	1100	234
19	AHU14000	14,000 CFM AHU, COOLING ONLY	EA.	$6,700	$6,492	Q-6	$20.1	57.14	1650	234
20	AHU1900	1,900 CFM AHU, COOLING ONLY	EA.	$2,200	$2,132	Q-5	$19.4	14.55	1200	234
21	AHU3200	3,200 CFM AHU, COOLING ONLY	EA.	$2,600	$2,519	Q-5	$19.4	20.00	1300	234
22	AHU5400	5,400 CFM AHU, COOLING ONLY	EA.	$3,925	$3,803	Q-6	$20.1	30.00	1400	234
23	AHU6750	6,750 CFM AHU, HEATING ONLY	EA.	$4,262	$4,130	Q-5	$19.4	35.00	1300	234
24	AHU8000	8,000 CFM AHU, COOLING ONLY	EA.	$4,575	$4,433	Q-6	$20.1	40.00	1500	234
25	AHUCNTL	AHU SA CONTROLLER	EA.	$220	$213.19	1-ELEC	$20.9	2.00	BARBER	brb/men
26	AHUH1000	10,000 CFM AHU	EA.	$5,970	$5,785	Q-6	$20.1	46.67	1550	234
27	AHUH1200	12,000 CFM AHU	EA.	$6,810	$6,599	Q-6	$20.1	54.78	1600	234
28	AHUH1300	1,300 CFM AHU	EA.	$2,370	$2,297	Q-5	$19.4	14.00	1100	234
29	AHUH1900	1,900 CFM AHU	EA.	$2,640	$2,558	Q-5	$19.4	15.27	1200	234
30	AHUH3200	3,200 CFM AHU	EA.	$3,120	$3,023	Q-5	$19.4	21.00	1300	234
31	AHUH5400	5,400 CFM AHU	EA.	$4,710	$4,564	Q-6	$20.1	31.50	1400	234
32	AHUH8000	8,000 CFM AHU	EA.	$5,490	$5,320	Q-6	$20.1	42.00	1500	234
33	AHUHEAT	COST OF HEATING COIL IN AHU	EA.	21.00%	$0.20	5%			2200	235
34	BBRD36	CAST IRON RADIATOR, 36.5 MBH	EA.	$625	$605.63	Q-5	$19.4	2.00	4040	194

MATERIAL & LABOR COST LOOK UP TABLE

PROJECT	Fort Riley Feasibility Study for HVAC Upgrade	
ENGINEER	E M C Engineers, Inc. Denver, CO	
SHEET	2 OF 6	
DATE PREPARED	9-May-95	
PREPARED BY	C. Wohlert	
CHECKED BY	A. Niemeyer	

Line No.	Item Refer Code	Item Description	Unit of Measure	Material Average Cost	Location Adj. Cost 0.969	Labor Code	Labor Cost/Hr.	Labor Time (Hrs)	"Means" Line No.	"Means" Page No.
35	BOIL6.97	CAST IRON STEAM BOILER, 6.97 MBH	EA.	$53,000	$51,357	Q-7	$20.6	400.00	2540	172
36	CLGCOIL1	COOLING COIL, 2ROW, 30" x 30"	EA.	$510	$494.19	Q-5	$19.4	6.25	2170	245
37	CNTV0.5	CONTROL VALVE 1/2"	EA.	$150	$145.35	1-PLUM	$21.5	0.36	8190	272
38	CNTV0.75	CONTROL VALVE 3/4"	EA.	$158	$153.10	1-PLUM	$21.5	0.44	8200	272
39	CNTV1	CONTROL VALVE 1"	EA.	$197	$190.89	1-PLUM	$21.5	0.47	8210	272
40	CNTV1.25	CONTROL VALVE 1-1/4"	EA.	$240	$232.56	1-PLUM	$21.5	0.53	8090	272
41	CNTV1.5	CONTROL VALVE 1-1/2"	EA.	$285	$276.17	1-PLUM	$21.5	0.73	8220	272
42	CNTV2	CONTROL VALVE 2"	EA.	$410	$397.29	1-PLUM	$21.5	0.89	8230	272
43	CNTV2.5	CONTROL VALVE 2-1/2"	EA.	$965	$935.09	1-PLUM	$21.5	3.56	8570	272
44	CNTVLV2	2" CONTROL VALVE,3-WAY,DDC	EA.	$1,000	$969.00	1-PLUM	$21.5	3.00	BARBER	COLMAN
45	COIL	CONDENSER COIL (PLUS COVER)	EA	$750	$726.75	Q-5	$19.4	13.00	1380	244
46	CONT	CONTINGENCY			20.00%					
47	CT1	COOLING TOWER, <60 TONS	TON-AC	$100	$96.90	Q-6	$20.1	23.75	100	253
48	CUPIP0.75	COPPER PIPE TYPE L, 0.75" W/HANGERS	L.F.	$2	$1.84	1-PLUM	$21.5	0.11	2180	74
49	CUPIP2	COPPER PIPE TYPE L, 2" W/HANGERS	L.F.	$6	$5.96	1-PLUM	$21.5	0.19	2260	74
50	CUPIP3	COPPER PIPE TYPE L, 3" W/HANGERS	L.F.	$12	$11.19	Q-1	$19.4	0.29	2300	74
51	CV0.5	CONTROL VALVE 1/2" (INCL. DEMO)	EA.	$150	$145.35	1-PLUM	$21.5	0.55	8190	272
52	CV0.75	CONTROL VALVE 3/4" (INCL. DEMO)	EA.	$158	$153.10	1-PLUM	$21.5	0.67	8200	272
53	CV1	CONTROL VALVE 1" (INCL. DEMO)	EA.	$197	$190.89	1-PLUM	$21.5	0.71	8210	272
54	CV1.25	CONTROL VALVE 1-1/4" (INCL. DEMO)	EA.	$240	$232.56	1-PLUM	$21.5	0.80	8090	272
55	CV1.5	CONTROL VALVE 1-1/2" (INCL. DEMO)	EA.	$285	$276.17	1-PLUM	$21.5	1.09	8220	272
56	CV2	CONTROL VALVE 2" (INCL. DEMO)	EA.	$410	$397.29	1-PLUM	$21.5	1.33	8230	272
57	CV2.5	CONTROL VALVE 2-1/2" (INCL. DEMO)	EA.	$965	$935.09	1-PLUM	$21.5	5.33	8570	272
58	DMP28X44	DAMPER W/ ACT, 28" X 44"	EA.	$287	$278.10	Q-9	$18.7	2.00	160	E122
59	DMPACT	DAMPER ACTUATOR (INCL. DEMO)	EA.	$197	$190.89	1-STPI	$21.5	1.50	9052	273
60	DTINSL0.5	0.5" FIBERGLASS LINER, 2LB DENSITY	S.F.	$0	$0.37	Q-14	$18.4	0.04	3050	196
61	DTINSL1"	DUCT INSLULATION, 1" THICK	S.F.	$1	$0.48	Q-14	$18.4	0.05	3060	196
62	DTINSL2"	DUCT INSLULATION, 2" THICK	S.F.	$1	$0.83	Q-14	$18.4	0.05	3080	196
63	DTMOD1	MODIFY DUCTWORK FOR STEAM COIL	EA.	$200	$193.80	Q-5	$19.4	20.00	Estimated	
64	DUCT1000	GAL. STEEL DUCTWORK, 500 TO 1000 LB.	LB.	$0	$0.47	Q-10	$19.4	0.09	540	253
65	DUCT200	GAL. STEEL DUCTWORK, UNDER 200 LB.	LB.	$2	$1.51	Q-10	$19.4	0.10	500	253
66	DUCT2000	GAL. STEEL DUCTWORK, 1000 TO 2000 LB.	LB.	$0	$0.45	Q-10	$19.4	0.09	560	253
67	DUCT500	GAL. STEEL DUCTWORK, 200 TO 500 LB.	LB.	$0	$0.47	Q-10	$19.4	0.10	520	253
68	DUCT5000	GAL. STEEL DUCTWORK, 2000 TO 5000 LB.	LB.	$0	$0.45	Q-10	$19.4	0.09	570	253

MATERIAL & LABOR COST LOOK UP TABLE

SHEET 3 OF 6

PROJECT	Fort Riley Feasibility Study for HVAC Upgrade	**DATE PREPARED**	9-May-95
ENGINEER	E M C Engineers, Inc.	**PREPARED BY**	C. Wohlert
	Denver, CO	**CHECKED BY**	A. Niemeyer

Line No.	Item Refer Code	Item Description	Unit of Measure	Material Average Cost	Location Adj. Cost 0.969	Labor Code	Labor Cost/Hr.	Labor Time (Hrs)	"Means" Line No.	"Means" Page No.
69	E-TSTAT1	SINGLE SETPOINT ELEC. TSTAT, 3 WIRE	EA.	$25	$24.23	1-ELEC	$20.9	0.80	5230	271
70	ELCND1	ELECTRICAL CONDUIT 1"	L.F.	$1	$0.83	1-ELEC	$20.9	0.06	9120	E82
71	ELE-SWIT	DDC SWITCH	EA.	$72	$69.77	1-STPI	$21.5	0.50	9045	273
72	EXHOD1.3	ROOF EXHAUSTER, 1,300 CFM	EA.	$495	$479.66	Q-20	$19.2	4.00	7780	267
73	EXHOD11	ROOF EXHAUSTER, 11,000 CFM	EA.	$2,050	$1,986.45	Q-20	$19.2	10.00	7840	267
74	EXHOD3.6	ROOF EXHAUSTER, 3,600 CFM	EA.	$850	$823.65	Q-20	$19.2	5.00	7780	267
75	FAC1	FURNACE AIR CONDITIONER, 4 TON	EA.	$1,840	$1,782.96	Q-9	$18.7	20.00	LENNOX	
76	FAC2	FURNACE AIR CONDITIONER, 5 - 6 TON	EA.	$2,680	$2,596.92	Q-10	$19.4	24.00	LENNOX	
77	FANBRG	FAN BEARING (INCL. DEMO)	EA.	$17	$15.99	Q-9	$18.7	4.00	Grainger	286
78	FC-1TON	FAN COIL, CW, CABINET, 1 TON	EA.	$695	$673.46	Q-6	$20.1	2.67	120	236
79	FTR1.25ST	FINNED TUBE RAD. - 1.25" STEEL TUBE, STEE	L.F.	$30	$28.59	Q-1	$19.4	0.44	1250	194
80	FURN125	PULSE COMB FURNACE 125,000 BTUH	EA.	$2,500	$2,422.50	Q-10	$19.4	26.00	LENNOX	
81	FURN150	PULSE COMB FURNACE 150,000 BTUH	EA.	$2,800	$2,713.20	Q-10	$19.4	28.00	LENNOX	
82	GASCN	FLEXIBLE CONNECTOR 12" LONG	EA.	$8	$7.90	1-PLUM	$21.5	0.22	200	64
83	GASKET	CONDENSATE PUMP GASKET	EA.	$15	$14.54	1-PLUM	$21.5	1.00	700	122
84	HWBLR1	765 MBH HOT WATER BOILER (Cast Iron)	EA.	$5,525	$5,353.73	Q-7	$20.6	58.18	3240	172
85	HWBLR2	1,613 MBH HOT WATER BOILER	EA.	$10,100	$9,786.90	Q-7	$20.6	76.19	3300	172
86	HWBLR3	2,312 MBH HOT WATER BOILER	EA.	$14,500	$14,050.50	Q-7	$20.6	88.89	3340	172
87	HWBLR4	400 MBH HW BOILER, PWR BURNER, CONTRO	EA.	$5,350	$5,184.15	Q-6	$20.1	30.00	6160	173
88	HWP1	1/3 HP, CI FLANGE, IN-LINE, 3/4"-1-1/2" SIZE	EA.	$310	$300.39	Q-1	$19.4	2.67	2100	166
89	INSLPIP0.7	0.75" FIBERGLASS PIPE INSULATION, 1" THCK	L.F.	$0.63	$0.61	Q-14	$18.4	0.07	6860	201
90	INSLPIP1	1" FIBERGLASS PIPE INSULATION, 1" THCK	L.F.	$0.64	$0.62	Q-14	$18.4	0.07	6870	201
91	INSLPIP1.2	1.25" FIBERGLASS PIPE INSULATION, 1.5" THC	L.F.	$1.44	$1.40	Q-14	$18.4	0.08	7120	201
92	INSLPIP2	2" FIBERGLASS PIPE INSULATION, 1.5" THCK	L.F.	$1.51	$1.46	Q-14	$18.4	0.08	7140	201
93	INSLPIP2.5	2.5" FIBERGLASS PIPE INSULATION, 1.5" THCK	L.F.	$1.65	$1.60	Q-14	$18.4	0.09	7150	201
94	INSLPIP3	3" FIBERGLASS PIPE INSULATION, 1.5" THCK	L.F.	$1.71	$1.66	Q-14	$18.4	0.09	7160	201
95	INSLPIP4	4" FIBERGLASS PIPE INSULATION, 1.5" THCK	L.F.	$1.95	$1.89	Q-14	$18.4	0.11	7180	201
96	INSLPIP6	6" FIBERGLASS PIPE INSULATION, 1.5" THCK	L.F.	$2.25	$2.18	Q-14	$18.4	0.15	7200	201
97	INT-VN1,10	1 SIDE INLET VANES RET-FIT, 21"	EA.	$1,320	$1,279.08	Q-20	$19.2	5.50	BARRY	BLOWER
98	INT-VN1,3.	1 SIDE INLET VANES RET-FIT, 13"	EA.	$1,055	$1,022.30	Q-20	$19.2	5.50	BARRY	BLOWER
99	INT-VN1,40	1 SIDE INLET VANES RET-FIT, 38"	EA.	$2,665	$2,582.39	Q-20	$19.2	6.00	BARRY	BLOWER
100	IRHEAT	GAS FIRED IR TUBE SYSTEMS / BURNER	EA.	$1,615	$1,564.94	Q-6	$20.1	18.24	CoRayVac	
101	IRHT30	GAS FIRED IR HEATER, 30 MBH	EA.	$335	$324.62	Q-5	$19.4	2.67	100	186
102	KHRU1	KITCHEN HEAT RECOVERY UNIT, 3000 CFM	EA.	$13,200	$12,790.80	Q-6	$20.1	25.00	Gaylord	QUOTE

MATERIAL & LABOR COST LOOK UP TABLE

PROJECT	Fort Riley Feasibility Study for HVAC Upgrade	**SHEET**	4 OF 6
ENGINEER	E M C Engineers, Inc.	**DATE PREPARED**	9-May-95
	Denver, CO	**PREPARED BY**	C. Wohlert
		CHECKED BY	A. Niemeyer

Line No.	Item Refer Code	Item Description	Unit of Measure	Material Average Cost	Location Adj. Cost 0.969	Labor Code	Labor Cost/Hr.	Labor Time (Hrs)	"Means" Line No.	"Means" Page No.
103	KHRU2	KITCHEN HEAT RECOVERY UNIT, 4250 CFM	EA.	$14,640	$14,186.16	Q-6	$20.1	30.00	Gaylord	QUOTE
104	KHRU5	KITCHEN HEAT RECOVERY UNIT, 8,500 CFM	EA.	$18,000	$17,442.00	Q-6	$20.1	32.00	Gaylord	QUOTE
105	KHRU8	KITCHEN HEAT RECOVERY UNIT, 14,500 CFM	EA.	$22,800	$22,093.20	Q-6	$20.1	36.00	Gaylord	QUOTE
106	KHRU9C	KITCHEN HEAT RECOVERY UNIT, 19,000 CFM	EA.	$29,200	$28,294.80	Q-6	$20.1	40.00	Gaylord	QUOTE
107	MCUPIP1	COPPER TUBE, TYPE L, 3/4" OD	L.F.	$1	$1.41	1-PLUM	$21.5	0.10	3180	74
108	MCUPIP2	COPPER TUBE, TYPE L, 1-1/4" OD	L.F.	$3	$2.60	1-PLUM	$21.5	0.13	3180	74
109	MNT-AHU	MAINT. ON AHU - INSPEC. / YR > 5000 CFM	EA.			Q-6	$20.1	25.00	Estimated	
110	MNT-AHU1	MAINT. ON AHU - INSPEC. / YR <= 5000 CFM	EA.			Q-6	$20.1	19.00	Estimated	
111	MNT-BLR1	MAINT. ON BOILERS - >2.5 MBH	EA.	$100	$96.90	Q-6	$20.1	25.00	Estimated	
112	MNT-BLR2	MAINT. ON BOILERS - <2.5 MBH	EA.	$50	$48.45	Q-6	$20.1	17.00	Estimated	
113	MNT-CH1	MAINT. ON CHLR, AIR-CLD, <20 TONS. / YR	EA.	$0.00	$0.00	Q-6	$20.1	10.00	Estimated	
114	MNT-CT1	MAINT. ON CLG TOWER, <20 TONS. / YR (EXIS	EA.	$50.00	$48.45	Q-6	$20.1	15.00	Estimated	
115	MNT-FAC	MAINT. ON FAC - INSPEC. / YR	EA.			Q-6	$20.1	4.00	Estimated	
116	MNT-FC	MAINT. ON FCs - INSPEC. / YR	EA.			Q-6	$20.1	4.00	Estimated	
117	MNT-IR	MAINT. ON IR HEATERS - INSPEC. / YR	EA.			Q-6	$20.1	4.00	Estimated	
118	MNT-UH	MAINT. ON UHS - INSPEC. / YR	EA.			Q-6	$20.1	4.00	Estimated	
119	MODBLR1	MODULAR HW BOILER, 320 MBH	EA.	$2,725	$2,641	Q-7	$20.6	40.00	3140	172
120	MTR1.5	FAN MOTOR, 1-1/2 HP	EA.	$200	$193.80	1-ELEC	$20.9	2.67	150	E176
121	MTR5	FAN MOTOR, 5 HP	EA.	$240	$232.56	1-ELEC	$20.9	2.67	250	E176
122	MTR7.5	FAN MOTOR, 7-1/2 HP	EA.	$340	$329.46	1-ELEC	$20.9	2.86	300	E176
123	MZ15TON	15 TON MULTIZONE AHU	EA.	$32,110	$31,115	Q-7	$20.6	145.00	2100	239
124	OH	OVERHEAD			16.80%					
125	PATCH	PATCH DUCTWORK	JOB	$5	$4.85	1-SHEE	$20.8	1.00	Estimated	
126	PMP1.5HP	PUMP, 1.5 HP	EA	$870	$843.03	Q-1	$19.4	5.33	4040	166
127	PMP1/3HP	PUMP MOTOR, 1/3 HP (INCL. DEMO)	EA.	$200	$193.80	1-ELEC	$20.9	3.78	100	E176
128	PMP10HP	PUMP MOTOR, 10 HP (INCL. DEMO)	EA.	$470	$455.43	1-ELEC	$20.9	4.00	350	E176
129	PMP2HP	PUMP, 2 HP (INCL. DEMO)	EA	$895	$867.26	Q-1	$19.4	7.40	4090	166
130	PMP2ND	PUMP, 2 HP, NO DEMO	EA	$895	$867.26	Q-1	$19.4	5.33	4090	166
131	PMP3/4HP	PUMP, 3/4 HP, (INCL. DEMO)	EA.	$640	$620.16	Q-1	$19.4	6.40	3040	166
132	PMP3HP	PUMP, 3 HP	EA	$975	$944.78	Q-1	$19.4	6.98	4100	166
133	PMP5HP	PUMP, 5 HP	EA	$1,150	$1,114.35	Q-1	$19.4	8.89	4300	166
134	PMPBRG	PUMP BEARING (INCL. DEMO)	EA.	$17	$15.99	Q-1	$19.4	6.00	Grainger	286
135	PRO	PROFIT			10.00%					
136	PROPGLY	PROPYLENE GLYCOL FLUSH & FILL	GAL.	$7	$6.49	1-PLUM	$21.5	0.14	2100	270

MATERIAL & LABOR COST LOOK UP TABLE

PROJECT	Fort Riley Feasibility Study for HVAC Upgrade	SHEET	5 OF 6
ENGINEER	E M C Engineers, Inc.	DATE PREPARED	9-May-95
	Denver, CO	PREPARED BY	C. Wohlert
		CHECKED BY	A. Niemeyer

Line No.	Item Refer Code	Item Description	Unit of Measure	Material Average Cost	Location Adj. Cost 0.969	Labor Code	Labor Cost/Hr.	Labor Time (Hrs)	"Means" Line No.	"Means" Page No.
137	PSEAL	PUMP SEAL (INCL. DEMO)	EA.	$15	$14.54	Q-1	$19.4	10.00	Grainger	2273
138	REHEAT1	REHEAT COIL, 2ROW, 12"x12"	EA.	$124	$120.16	Q-5	$19.4	0.66	3850	246
139	REHEAT1.5	REHEAT COIL, 2ROW, 1.5'x1'	EA.	$134	$129.36	Q-5	$19.4	1.32	3860	246
140	REHEAT2	REHEAT COIL, 2ROW, 24"x12"	EA.	$143	$138.57	Q-5	$19.4	1.32	3860	246
141	REHEAT3	REHEAT COIL, 2ROW, 3'x1'	EA.	$159	$154.07	Q-5	$19.4	1.32	3860	246
142	REHEAT4	REHEAT COIL, 2ROW, 3' x 2'	EA.	$200	$193.80	Q-5	$19.4	3.96	3930	246
143	ROFEXH15	ALUMINUM GALV. ROOF INTAKE, 15,000 CFM	EA.	$2,700	$2,616.30	Q-9	$18.7	12.30	5780	289
144	ROFEXH25	ALUMINUM GALV. ROOF INTAKE, 25,000 CFM	EA.	$4,100	$3,972.90	Q-9	$18.7	17.78	5780	289
145	SHUTOFF	CONDENSATE SHUT-OFF CONTROLS	EA.	$60	$58.14	1-ELEC	$20.9	1.00	173	E173
146	STLPIP0.5	STEEL PIPE SCH. 40, 0.5" W/HANGERS	L.F.	$1	$1.33	1-PLUM	$21.5	0.20	560	103
147	STLPIP0.75	STEEL PIPE SCH. 40, 0.75" W/HANGERS	L.F.	$2	$1.51	1-PLUM	$21.5	0.20	570	103
148	STLPIP1	STEEL PIPE SCH. 40, 1" W/HANGERS	L.F.	$2	$2.10	Q-1	$19.4	0.15	580	103
149	STLPIP1.25	STEEL PIPE SCH. 40, 1.25" W/HANGERS	L.F.	$3	$2.56	Q-1	$19.4	0.20	590	103
150	STLPIP1.5	STEEL PIPE SCH. 40, 1.5" W/HANGERS	L.F.	$3	$2.95	Q-1	$19.4	0.20	600	103
151	STLPIP2	STEEL PIPE SCH. 40, 2" W/HANGERS	L.F.	$4	$3.91	Q-1	$19.4	0.25	610	103
152	STLPIP2.5	STEEL PIPE SCH. 40, 2.5" W/HANGERS	L.F.	$5	$5.28	Q-15	$19.4	0.34	2080	104
153	STLPIP3	STEEL PIPE SCH. 40, 3" W/HANGERS	L.F.	$7	$6.40	Q-15	$19.4	0.37	2090	104
154	STLPIP4	STEEL PIPE SCH. 40, 4" W/HANGERS	L.F.	$9	$9.16	Q-15	$19.4	0.43	2110	104
155	STLPIP6	STEEL PIPE SCH. 40, 6" W/HANGERS	L.F.	$19	$17.93	Q-16	$21.7	0.67	2130	104
156	STMBLR1	1,000 MBH STEAM BOILER (Cast Iron)	EA.	$6,900	$6,686	Q-7	$20.6	80.00	2260	172
157	STMCOIL1	36X36 STEAM COIL	EA.	$510	$494.19	Q-5	$19.4	5.93	4660	246
158	STMCOIL2	36X84 STEAM COIL (INCL. DEMO)	EA.	$925	$896.33	Q-5	$19.4	17.91	6260	247
159	UH300	UNIT HEATER, 297 MBH	EA.	$1,425	$1,380.83	Q-5	$19.4	8.00	5140	195
160	UH325	HORIZ. UNIT HEATER, PROPELLER, 133.3 MBH	EA.	$930	$901.17	Q-5	$19.4	3.20	4160	194
161	UH7	HORIZ. UNIT HEATER, PROPELLER, 87.6 MBH	EA.	$755	$731.60	Q-5	$19.4	2.46	4120	194
162	UH9	HORIZ. UNIT HEATER, PROPELLER, 133.3 MBH	EA.	$930	$901.17	Q-5	$19.4	3.20	4160	194
163	VAVBX12	VAV BOX, 1200 CFM, ELEC	EA.	$280	$271.32	1-SHEE	$20.8	1.13	BARBER	KRUGER
164	VAVBX20	VAV BOX, 2000 CFM, ELEC	EA.	$288	$279.07	1-SHEE	$20.8	1.22	BARBER	KRUGER
165	VAVBX24	VAV BOX, 2400 CFM, ELEC	EA.	$297	$287.31	1-SHEE	$20.8	1.33	BARBER	KRUGER
166	VAVBX35	VAV BOX, 3500 CFM, ELEC	EA.	$320	$310.08	1-SHEE	$20.8	1.48	BARBER	KRUGER
167	VAVBX5	VAV BOX, 500 CFM, ELEC	EA.	$275	$266.48	1-SHEE	$20.8	0.98	BARBER	KRUGER
168	VAVBX70	VAV BOX, 7000 CFM, ELEC	EA.	$365	$353.69	1-SHEE	$20.8	2.60	BARBER	KRUGER
169	VAVBX8	VAV BOX, 800 CFM, ELEC	EA.	$278	$269.38	1-SHEE	$20.8	1.00	BARBER	KRUGER
170	VAVCNTL1	VAV BOX CONTROLLER & ACTUATOR, DDC	EA.	$270	$261.63	1-ELEC	$20.9	0.33	BARBER	COLMAN

MATERIAL & LABOR COST LOOK UP TABLE

PROJECT	Fort Riley Feasibility Study for HVAC Upgrade
ENGINEER	E M C Engineers, Inc. Denver, CO
SHEET	6 OF 6
DATE PREPARED	9-May-95
PREPARED BY	C. Wohlert
CHECKED BY	A. Niemeyer

Line No.	Item Refer Code	Item Description	Unit of Measure	Material Average Cost	Location Adj. Cost 0.969	Labor Code	Labor Cost/Hr.	Labor Time (Hrs)	"Means" Line No.	"Means" Page No.
171	VAVCNTL2	VAV BOX CONTROLLER & ACTUATOR, ELEC	EA.	$160	$155.04	1-ELEC	$20.9	0.33	BARBER	COLMAN
172	VNTFAN1	6700 CFM UTILITY FAN, V-BELT DRIVE	EA.	$1,125	$1,090.13	Q-20	$19.2	6.67	7820	267
173	VSD10	VARIABLE SPEED DRIVE W/ CONTRLER,10HP	EA.	$3,300	$3,197.70	1-ELEC	$20.9	12.50	PENCE	MEANS
174	VSD15	VARIABLE SPEED DRIVE W/ CONTRLER,15HP	EA.	$4,190	$4,060.11	1-ELEC	$20.9	19.00	PENCE	MEANS
175	VSD20	VARIABLE SPEED DRIVE W/ CONTRLER,20HP	EA.	$4,999	$4,844.03	1-ELEC	$20.9	19.00	PENCE	MEANS
176	VSD25	VARIABLE SPEED DRIVE W/ CONTRLER,25HP	EA.	$5,600	$5,426.40	1-ELEC	$20.9	25.00	PENCE	MEANS
177	VSD3	VARIABLE SPEED DRIVE W/ CONTRLER,3HP	EA.	$2,310	$2,238.39	1-ELEC	$20.9	10.50	PENCE	MEANS
178	VSD5	VARIABLE SPEED DRIVE W/ CONTRLER,5HP	EA.	$2,523	$2,444.79	1-ELEC	$20.9	10.50	PENCE	MEANS
179	VSD7.5	VARIABLE SPEED DRIVE W/ CONTRLER,7.5HP	EA.	$2,816	$2,728.70	1-ELEC	$20.9	12.50	PENCE	MEANS
180	WAC0.5	WINDOW AIR CONDITIONER, 1/2 TON	EA.	$390	$377.91	1-CARP	$18.3	1.00	4340	243
181	WAC1	WINDOW AIR CONDITIONER, 1 TON	EA.	$550	$532.95	L-2	$16.1	2.00	4340	243
182	WAC1.5	WINDOW AIR CONDITIONER, 1.5 TON	EA.	$775	$750.98	L-2	$16.1	2.67	4780	243
183	WCHLR1	20 TON WATER CHILLER, RECIP., AIR COOLED	EA.	$11,500	$11,144	Q-7	$20.6	91.43	500	241
184	WIRE#12	COPPER WIRING #12	C.L.F.	$8	$7.41	1-ELEC	$20.9	0.73	100	E122
185	WIRE#6	COPPER WIRING #6	C.L.F.	$26	$24.71	1-ELEC	$20.9	1.23	160	E122

LABOR COST LOOK UP TABLE		SHEET 1	OF 1
PROJECT	Fort Riley Feasibility Study for HVAC Upgrade	DATE PREPARED	15-Mar-95
ENGINEER	E M C Engineers, Inc.	PREPARED BY	C. Wohlert
	Denver, CO	CHECKED BY	A. Niemeyer

Line No.	Item Refer Code	Item Description	Average Cost $/hr	Location Adj. Cost 0.761	"Means" Page No.
1	1-CARP	CARPENTER	$24.00	$18.26	432
2	1-CLAB	LABORERS	$19.00	$14.46	434
3	1-ELEC	ELECTRICIAN	$27.50	$20.93	E386
4	1-PLUM	PLUMBER	$28.30	$21.54	433
5	1-SHEE	SHEET METAL WORKER	$27.35	$20.81	434
6	1-STPI	STEAMFITTER, PIPEFITTER	$28.30	$21.54	434
7	2-ELEC	TWO ELECTRICIANS	$55.00	$41.86	E386
8	L-2	CARPENTER & HELPER	$21.20	$16.13	433
9	Q-1	PLUMPER & APPRENTICE	$25.48	$19.39	433
10	Q-10	SHEET METAL CREW	$25.53	$19.43	434
11	Q-14	INSULATION CREW	$24.20	$18.42	434
12	Q-15	PLUMBING CREW	$25.48	$19.39	434
13	Q-16	PLUMBING CREW	$28.55	$21.73	434
14	Q-20	SHEET METAL CREW W/ ELECTRICIAL HELP	$25.20	$19.18	434
15	Q-5	STEAM FITTER	$25.48	$19.39	434
16	Q-6	STEAM FITTER CREW	$26.42	$20.11	434
17	Q-7	STEAM FITTER CREW	$27.01	$20.55	434
18	Q-9	SHEET METAL CREW	$24.63	$18.74	434
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MAINTENANCE COSTS ASSUMPTIONS

Preventative Maintenance

The following are assumptions made for preventative maintenance labor hours for typical HVAC equipment. The preventative maintenance hours include inspections, maintenance, and breakdown repairs. A yearly maintenance routine of monthly, quarterly, semi-annually, and annual inspections were assumed.

- Air Handling Units > 5,000 cfm are maintained:

  - 1 hour on monthly inspections (for 12 months) = 12 hrs/yr
  - 2 hours on quarterly inspections = 8 hrs/yr
  - 2 hours on semi-annual inspections = 4 hrs/yr
  - 1 hour on annual inspections = 1 hr/yr

  Total for Maintenance Labor Hours = 25 hrs/yr

- Air Handling Units <= 5,000 cfm are maintained:

  - 1 hour on monthly inspections (for 12 months) = 12 hrs/yr
  - 1 hours on quarterly inspections = 4 hrs/yr
  - 1 hours on semi-annual inspections = 2 hrs/yr
  - 1 hour on annual inspections = 1 hr/yr

  Total for Maintenance Labor Hours = 19 hrs/yr

- Boilers > 2.5 MBH are maintained:

  - 1 hour on monthly inspections (for 7 months) = 7 hrs/yr
  - 1 hour on quarterly inspections = 2 hrs/yr
  - 16 hours on annual inspections = 16 hr/yr
    (Includes cleaning and chemical treatment; Chemicals estimated at $100)

  Total for Maintenance Labor Hours = 25 hrs/yr

- Boilers < 2.5 MBH are maintained:

  - 1 hour on monthly inspections (for 7 months) = 7 hrs/yr
  - 1 hour on quarterly inspections = 2 hrs/yr
  - 8 hours on annual inspections = 8 hr/yr
    (Includes cleaning and chemical treatment;
    Chemicals estimated at $50)

  Total for Maintenance Labor Hours = 17 hrs/yr

- Existing Cooling Towers < 20 Tons are maintained:

  - 1 hour on monthly inspections (for 5 months) = 5 hrs/yr
  - 10 hours on annual inspections = 10 hr/yr
    (Includes cleaning and chemical treatment;
    Chemicals estimated at $50)

  Total for Maintenance Labor Hours = 15 hrs/yr

- Chiller with Air Cooled Condenser < or = 20 Tons are maintained:

  - 1 hour on monthly inspections (for 5 months) = 5 hrs/yr
  - 5 hours on annual inspections = 10 hr/yr

  Total for Maintenance Labor Hours = 15 hrs/yr

- Small HVAC equipment such as Fan Coils, Unit Heaters, Infrared Heaters, and Furnace Air Conditioners are maintained:

  - 1 hours on quarterly inspections = 4 hrs/yr

  Total for Maintenance Labor Hours = 4 hrs/yr

MEMORANDUM

TO: MR. ALLEN NIEMEYER
EMC ENGINEERS

FROM: RALPH PENCE

DATE: FEBRUARY 22, 1995

SUBJECT: ABB VARIABLE SPEED DRIVES
BUDGET PRICING - VARIABLE TORQUE APPLICATIONS

Allen,

Per your recent request, listed below please find List Pricing for ABB's ACH-500 series. The ACH-500 series is specifically designed for the HVAC industry, and comes standard with an H-O-A switch and manual speed pot. ACH specifications and standard features are also included for your review.

HP	ABB MODEL #	VFD	ADD BY-PASS (OPTIONAL)
3	ACH501-003-4-00P2	$2110.00	$1918.00
5	ACH501-005-4-00P2	2323.00	1981.00
7 1/2	ACH501-007-4-00P2	2616.00	2023.00
10	ACH501-010-4-00P2	3100.00	2090.00
15	ACH501-015-4-00P2	3990.00	2158.00
20	ACH501-020-4-00P2	4799.00	2298.00

The optional by-pass package includes:

- Extended enclosure (NEMA 1)
- Door Interlocked disconnect switch
- Motor overload relay
- 3-contactor by pass
- By-pass switch and service switch
- H-O-A switch and speed pot
- Customer safety circuit terminal strip
- 115 VAC control power transformer
- 3 pilot lights

Please remember these are list prices and allow margins for distribution and contractor mark-up.

Thank you for your interest in ABB drives.

Sincerely,

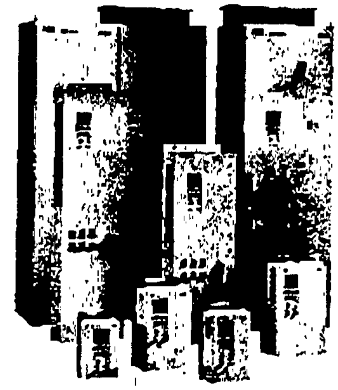
Ralph Pence

RP:bel

cc: Ed Hoover

ABB

AC DRIVES
ACH 500



3-350 HP @ 480 V
2-25 HP @ 230 V
Variable Torque

DESCRIPTION

The ACH 500 series is a microprocessor based Pulse Width Modulated (PWM) adjustable frequency AC drive. The ACH 500 drive takes advantage of sophisticated microprocessor control and advanced IGBT power switching technology to deliver high-performance control of AC motors for varied HVAC applications.

With drives ranging from 2 to 350 HP, the ACH 500 series features a universal alphanumeric interface that "speaks" to the operator in plain English phrases, greatly simplifying set-up, operation, and fault diagnosis.

Each ACH 500 drive comes equipped with three pre-programmed application macros, which at a touch of a button, allow rapid configuration of inputs, outputs, and performance parameters for fan and pump applications to maximize convenience and minimize start-up time.

The ACH 500 series can handle the most demanding of HVAC applications in an efficient, dependable, and economic manner.

STANDARD FEATURES

- UL Listed
- 40 Character Multi-lingual Alphanumeric Display For:
  - Output Frequency
  - Motor Speed (RPM, %, or user programmable)
  - Motor Current
  - Calculated Motor Torque
  - Calculated Motor Power
  - DC Bus Voltage
  - Output Voltage
  - Heatsink Temperature
  - Elapsed Time Meter
  - kWh Meter
  - Parameter Set-Up
  - Fault Text
  - Warning Text
  - Supervision Text
- RS-485 Communications
- Three position Hand-Off-Auto switch w/Speed Potentiometer
- Two (2) Analog Inputs
- Six (6) Programmable Digital Inputs
- Two (2) Programmable Analog Outputs
- Three (3) Programmable Digital Relay Outputs
- Adjustable Filters On Analog Inputs and Outputs
- Input Speed Signals:
  - Current 0(4)-20 mA
  - Voltage 0(2)-10 VDC
  - Accel/Decel Contacts
  - RS-485 Communications
- Start/Stop:
  - 2 Wire (Dry Contact Closure)
  - 3 Wire (Momentary Contacts)
  - Application Of Input Power
- All Control Inputs Isolated From Ground and Power
- Protection Circuits:
  - Over Current
  - Ground Fault
  - Over Voltage
  - Under Voltage
  - Over Temperature
  - Adaptable Electronic Motor Overload (I^2t)
- Programmable Maximum Frequency To 500 Hz (ACH 501)
- PI Setpoint Controller
- Seven (7) Preset Speeds
- Five (5) Critical Frequency Lockout Points
- Automatic Extended Power Loss Ride-Through
- Three (3) Current Limit Circuits
- Automatic Electronic Reverse
- Quick Reverse
- DC Injection Braking
- DC Hold
- Auto Restart-Customer Selectable and Adjustable
- Input Fuses
- Two (2) Independently Adjustable Accel and Decel Ramp
- Linear Or "S" Curve Accel/Decel Ramps
- Ramp Or Coast To A Stop
- V/Hz Shape:
  - Linear
  - Squared
  - Automatic
- Start Functions:
  - Ramp
  - Flying Start
  - Automatic Torque Boost
- Automatic Slip Compensation
- IR Compensation
- DC Line Reactor

OPTIONAL FEATURES

- Disconnect Switch
- Circuit Breaker
- Manual Bypass
- Automatic Bypass
- Service Switch
- Motor Overload Relays
- Analog Meters

ABB

AC DRIVES ACH 500

SPECIFICATIONS

Input Connection

Voltage (V_N) .... 3 phase, 440/460/480/500 +/-10% permitted tolerance
.... 3 phase, 208/220/230/240 +/-10% permitted tolerance
Frequency .... 48 ... 63 Hz
Power factor: For fundamental .... ~ 0.98

Motor Connection

Output voltage: .... 3φ 0 to V_{in} (V_{max} at field weakening point)
Output frequency: .... 0 to 500 Hz (ACH 501), 0 to 120 Hz (ACH 502)
Frequency resolution: .... 0.01 Hz Digital
.... 12 BIT - analog input 2
.... 10 BIT - analog input 1
Switching frequency (f_s) .... 1.0 to 12.0 kHz (ACH 501)
.... 3.0 kHz (ACH 502)
Continuous output current: .... Rated I_{RSC} (Nominal rated current, Variable Torque)
Overload Capacity: .... 110% of I_{RSC}, for 1 min every 10 min
Starting duty: .... 140% of I_{RSC} for 2 sec every 15 sec
Field weakening point: .... 30 to 500 Hz (ACH 501), 30 to 180 Hz (ACH 502)
Acceleration time: .... 0.1 to 1800 sec
Deceleration time: .... 0.1 to 1800 sec
Enclosure: .... NEMA 1
Environmental limits:
Ambient operating temperature (f_s=3kHz) .... 32 to 104°F (0 to 40°C) NEMA 1
Storage temperature: .... -40 to +158°F (-40 to +70°C)
Cooling mehod: .... Integral fan(s)
Relative humidity: .... max 95%, no condensation allowed
Altitude: max .... 3300 ft. (1000 m) above sea level (100% load)
.... 1% derating every 330 ft. above 3300 ft.

External Control Connections

Two programmable Analog Inputs:
Voltage reference: .... 0 to 10 V, 200k ohm single ended
Current reference: .... 0 to 20 mA, 250 ohms single ended
Potentiometer .... 10 V 10 mA (1K to 10K ohms)
Auxiliary voltage: .... +24 VDC, max 200 mA
Six Programmable Digital Inputs .... 24 VDC
Two Programmable Analog Outputs: .... 0 (4) to 20 mA, 500 ohm
Three Programmable Relay (Form C) Outputs:
Max switching voltage .... 300 VDC/250 VAC
Max switching current .... 8 A/24 VDC, 0.4 A/250 VDC
Max switching power .... 2000 VA/250 VAC
Max continuous current 2A
Protections:
Overcurrent trip limit: .... 315% instantaneous, 225% (RMS)
Slow current regulation limit: 125%
Rapid current regulation limit: 170%
Current switch-off limit: .... 255% instantaneous, 175% (RMS)
Overvoltage trip limit: 130%
Undervoltage trip limit: 65%
Overtemperature limit (heatsink): .... +158°F (+70°C) ACH 501, +185°F (+85°C) ACH 502
Auxiliary voltage: .... Short Circuit Protected
Ground fault: .... Running (ACH 501); At Start (ACH 502)
Microprocessor fault: .... Protected
Motor stall protection .... Protected
Motor overtemperature protection (I^2t) .... Protected
AC Line Fuses .... Standard

Specifications are subject to change without notice. Consult factory when specifications are critical.

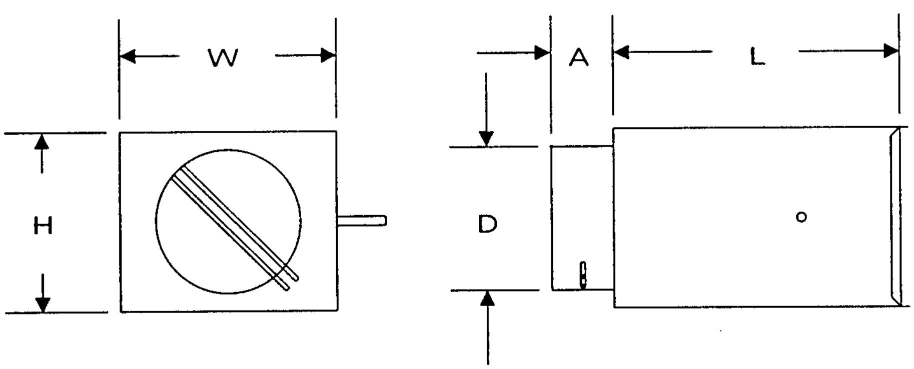
LMHS

Single Duct VAV Terminal Unit

	Inlet Size	Maximum CFM	D	A	H	W	L
1	4	235	3 7/8	5 3/8	8	12	15 1/2
2	5	375	4 7/8	5 3/8	8	12	15 1/2
3	6	530	5 7/8	3 3/8	8	12	15 1/2
	7	730	6 7/8	3 3/8	10	12	15 1/2
	8	945	7 7/8	3 3/8	10	12	15 1/2
	9	1200	8 7/8	3 3/8	12 1/2	14	15 1/2
	10	1450	9 7/8	3 3/8	12 1/2	14	15 1/2
	12	2150	11 7/8	3 3/8	15	16	15 1/2
	14	2950	13 7/8	3 3/8	17 1/2	20	15 1/2
	16	3800	15 7/8	3 3/8	18	24	15 1/2
	20	7250	23 7/8 x 15 7/8	3 11/16	18	38	15

Notes:
1. Unit shown is standard LMHS unit, which includes thermal/acoustical lining, heavy gauge construction, low leakage gasketed damper, Krueger linear flow probe with balancing taps.
2. Maximum and minimum controllable air volumes are listed on page 5.
3. 22 ga. construction is standard; 20 ga. is optional.

Diag.



4

LMHS

Single Duct VAV Terminal Unit
Recommended Unit Capacities

Use the chart below as a guide for selecting the correct LMHS unit size.

	LMHS		LMHS		ALMHS		DLMHS	
Control type	pneumatic		pneumatic		analog electronic		digital	
Control code	20		60		B		specify DDC vendor	
Unit Size	min.	max.	min.	max.	min.	max.	min.	max.
4	55-175	80-225	45-175	80-225	45-225	45-225	45-175	45-225
5	85-270	120-350	65-270	120-350	65-350	65-350	65-270	65-350
6	105-330	150-450	85-330	150-450	85-450	85-450	85-330	85-450
7	135-425	190-600	105-425	190-600	110-600	110-600	105-425	100-600
8	190-600	265-850	145-600	265-850	140-850	140-850	145-600	265-850
9	225-700	315-1050	175-700	315-1050	170-1050	170-1050	175-700	315-1050
10	300-925	415-1350	230-925	415-1350	240-1350	240-1350	230-925	415-1350
12	420-1330	600-2000	450-1330	600-2000	330-2000	330-2000	450-1330	600-2000
14	575-1800	810-2700	575-1800	810-2700	330-3200	330-3200	575-1800	810-2700
16	750-2400	1060-3500	580-2400	1060-3500	440-4000	440-4000	580-2400	1060-3500
24 x 16	1950-6200	2800-8000	1600-6200	2800-8000	n/a	n/a	1600-6200	2800-8000
Notes	1, 2, 3		1, 2, 3					

	ELMHS		ELMHS	
Control type	electric		electric	
Control code	A		L	
Unit Size	range	range	range	range
4	0	n/a	0	0-225
5	0	n/a	0	0-350
6	0	n/a	0	0-450
7	0	n/a	0	0-600
8	0	n/a	0	0-850
9	0	n/a	0	0-1050
10	0	n/a	0	0-1350
12	0	n/a	0	0-2000
14	0	n/a	0	0-2700
16	0	n/a	0	0-3500
24 x 16	0	n/a	0	0-8000
Notes	4	4	5	5

EXAMPLE: A zone exists requiring VAV control of a zone. The maximum flow is to be 500 CFM, the minimum is to be 175, based on reheat requirements. The control will be analog electronic.

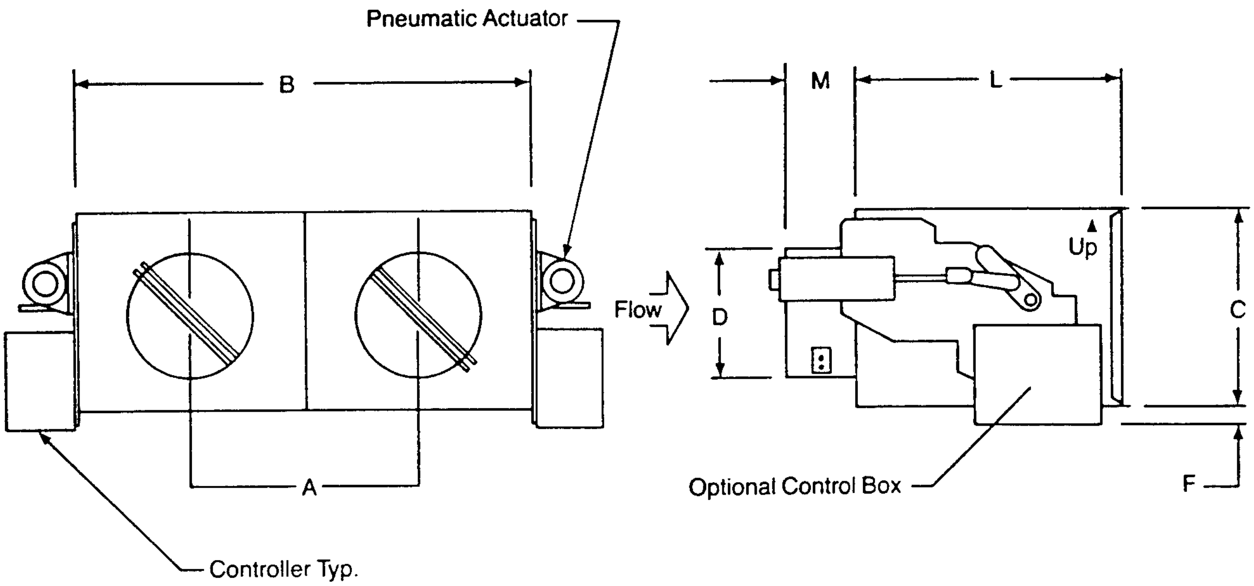
Use Table 1 above to select a size 8. Note that the size 7 or 9 will also be capable of controlling the required amount.

Notes:
1. CFM ranges are factory set on all pressure independent pneumatic and analog control schemes.
2. Factory set minimum CFMs are based on controllers ability to accurately maintain flow setting. Factory will not set controls outside the ranges indicated. Settings below indicated range will control less accurately.
3. Minimum CFM settings can be set low as 0 CFM; however, ventilation requirements can be met by setting a minimum greater than zero. Krueger recommends a minimum setpoint equal to 25% of the maximum setting.

Notes:
4. Code A electric controls are pressure dependent, and do not have the ability to control CFM settings. The minimum setting, therefore, is always zero. A set maximum flow rate is not possible.
5. Code L electric controls are pressure dependent, and maximum limiting, and do not have the ability to control minimum CFM settings. The minimum setting, therefore, is always zero.
6. The maximum flow rate is controlled by an adjustable airflow switch.

Dimensions

LMHD
Dual duct VAV terminal unit



LMHD

Inlet Size	CFM Range	A	B	C	D	F	L	M
4	0-255	12⅛	24⅛	8	3⅞	4 [illegible]	15½	5⅜
5	0-350	12⅛	24⅛	8	4⅞	4 [illegible]	15½	5⅜
6	0-450	12⅛	24⅛	8	5⅞	4 [illegible]	15½	3⅜
7	0-650	12⅛	24⅛	10	6⅞	3 [illegible]	15½	3⅜
8	0-800	12⅛	24⅛	10	7⅞	3 [illegible]	15½	3⅜
9	0-1050	14⅛	28⅛	12½	8⅞	2 [illegible]	15½	3⅜
10	0-1350	14⅛	28⅛	12½	9⅞	2 [illegible]	15½	3⅜
12	0-2100	16⅛	32⅛	15	11⅞	1 [illegible]	15½	3⅜
14	0-3200	20⅛	40⅛	17½	13⅞	[illegible]	15½	3⅜
16	0-4000	24⅛	48⅛	18	15⅞	N A	15½	3⅜

1. See LMHDT if integral mixer is required.
2. See Krueger Submittal Sheets for more information and dimensions on other control sequences.

E M C ENGINEERS, INC.
2750 S. Wadsworth Blvd. Suite C-200 Denver, CO 80227 (303) 988-2951
9755 Dogwood Rd. Suite 220 Roswell, GA 30075 (404) 642-1864

JOB HVAC Upgrade - FT Riley, KS.
SHEET NO. ______ OF ______
CALCULATED BY C. Wehlert DATE 2/22/95
CHECKED BY ______ DATE ______
SCALE ______

LMHS VAV Terminal Units.

Long + Associated

Tom Hurtner

Single Duct VAV Terminal unit LMHS Series

VV	Box inlet		cfm	cost per Box w/out controls/sensors	
	4			$65	for pressure independent Pneumatic operator sensor + controls
2	6	→	500 cfm		
3	8				
4	8	→	950 cfm	$65	add $45/Box
5	9			$68	
6	10			$71	for DDC
7	12	→	2150 cfm	$78	add ~ $300/Box

An Overview of VAV Terminals

Single Duct

TITUS single duct, variable volume terminal units can be selected for cooling only, cooling with reheat, heating only, or cooling-and-heating applications.

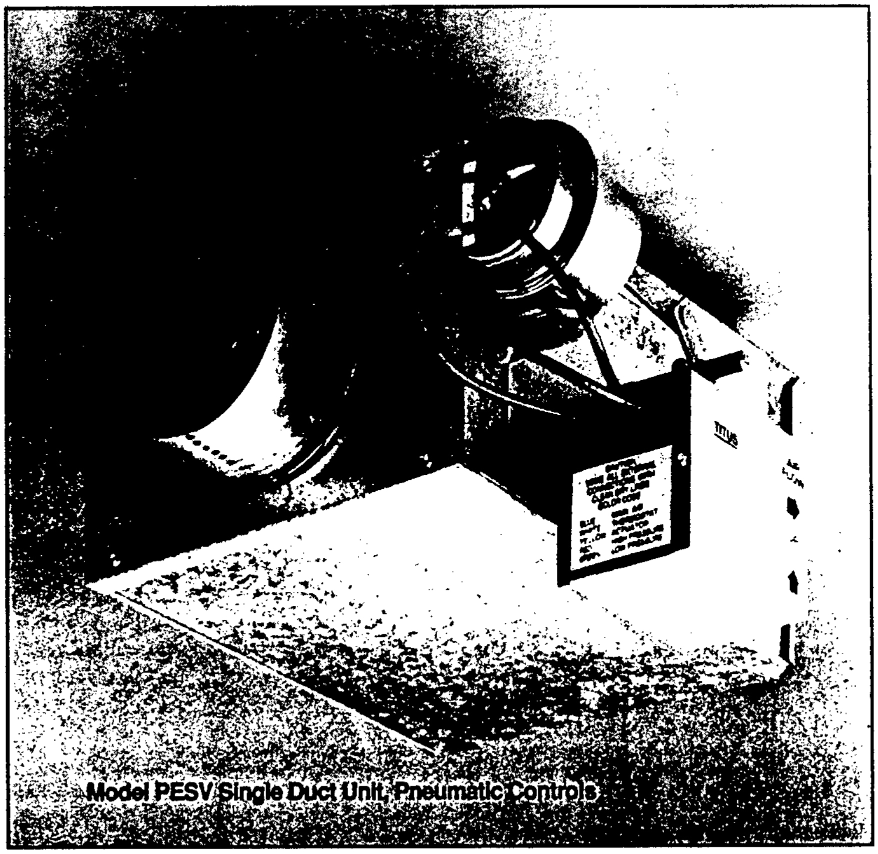
Controls available are:

▶ Pneumatic, pressure independent and pressure dependent.

▶ Analog electronic, pressure independent.

▶ Direct digital electronic, pressure independent.

▶ Electric, pressure dependent.



Model PESV Single Duct Unit, Pneumatic Controls

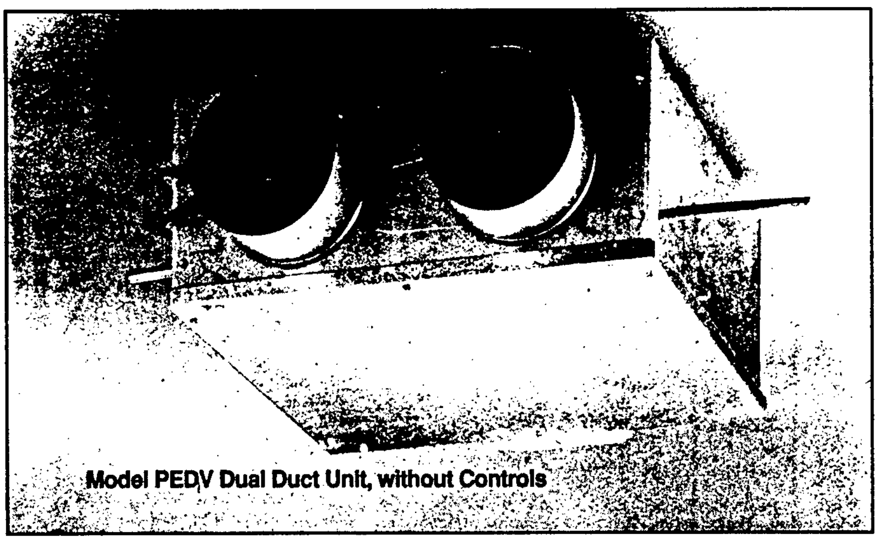
Dual Duct

TITUS dual duct, variable volume terminal units supply both hot and cold air in a variety of control sequences. Models are available for constant volume mixing of hot and cold air, as well as for non-mixing applications.

Controls available are:

▶ Pneumatic, pressure independent.

▶ Direct digital electronic, pressure independent.



Model PEDV Dual Duct Unit, without Controls

The Basic Terminal Unit

Low-Leakage Casing

Inlet Size	Leakage, CFM	
	$0.5"\Delta P_s$	$1.5"\Delta P_s$
4, 5, 6	1.5	3
7,8	1.5	3
9.10	2	4
12	3	5
14	4	6
16	5	7

Values for single duct unit or one side of Model EDV dual duct unit.

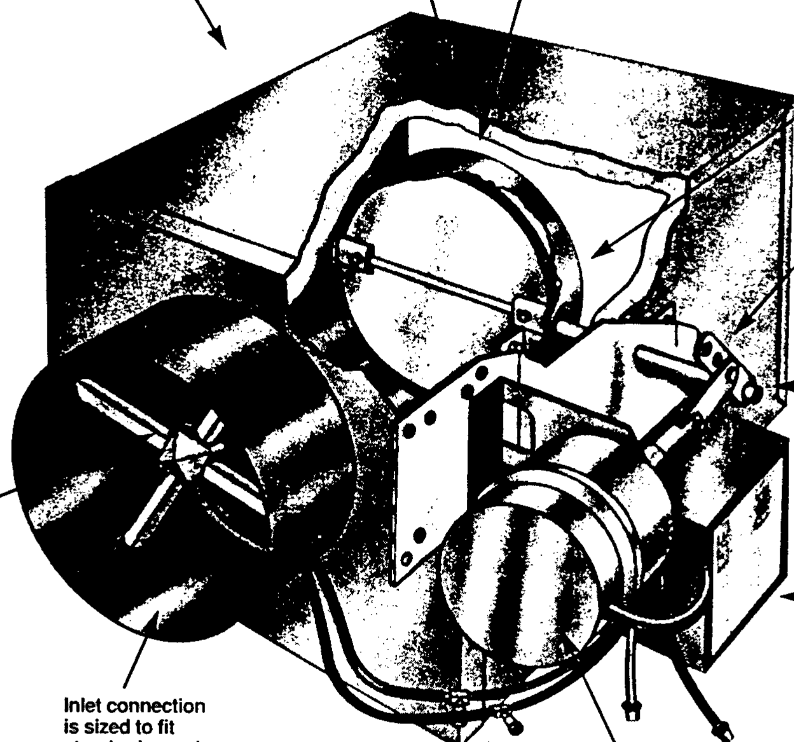
Tight Close-Off Damper

Inlet Size	Leakage, CFM		
	$1.5"\Delta P_s$	$3.0"\Delta P_s$	$6.0"\Delta P_s$
4, 5, 6	4	5	7
7, 8	4	5	7
9, 10	4	5	7
12	4	5	7
14	4	6	8
16	5	7	9

Values for single duct unit or one side of Model EDV dual duct unit.

Standard insulation is dual density, coated to resist air erosion. Meets requirements of NFPA 90A and UL 181.

TITUS damper design for low pressure drop and discharge sound power level.



Torque-free Delrin® bearings are unaffected by temperature and humidity.

Field convertible linkage allows NO/NC changeover without removing actuator.

Damper position indicator on end of shaft.

Multi-point, center-averaging sensor amplifies velocity pressure signals. Provides accurate flow sensing regardless of inlet duct configuration. (Optional)

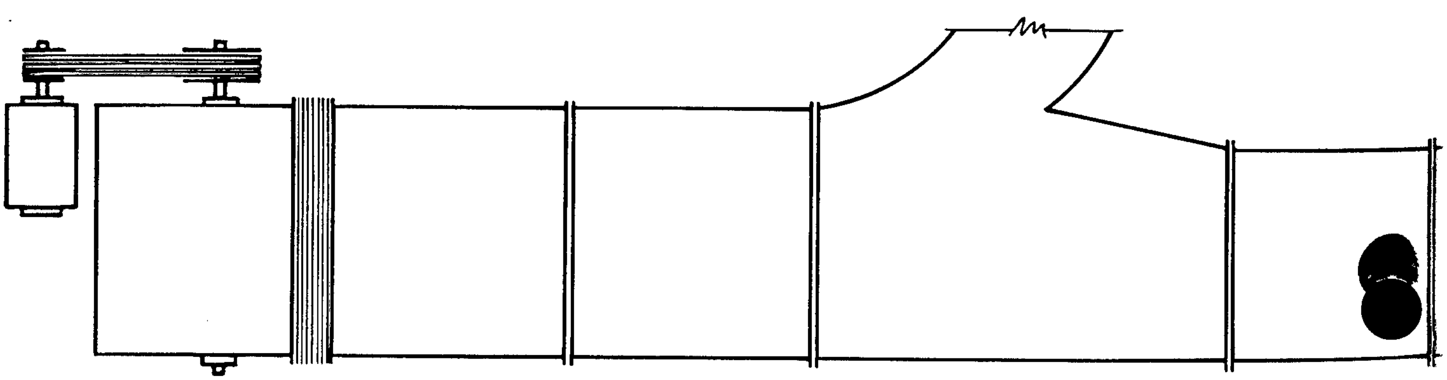
Controller. Pneumatic, electronic or digital. Pneumatic shown, with cover. (Optional)

Model PESV is illustrated.

Inlet connection is sized to fit standard round duct.

Damper actuator. Pneumatic or electric.

Flow measurement and balancing taps. (Provided with optional velocity sensor).



Benefits to the

Owner, Architect, Engineer, Installer, Balancer

The TITUS single or dual duct terminal unit is the basic module for a variable air volume (VAV) system. It precisely regulates the flow of air to a room or zone in response to a room thermostat or other signaling device.

The building owner benefits from low utility bills, as well as from a high level of occupant comfort. This is because the TITUS terminal unit controls air flow accurately at low duct pressures, with correspondingly low fan horsepowers.

The table below illustrates the amount of energy savings that can be expected.

Annual Power Cost/1000 cfm @ 6¢/kWh

Total Pressure	Fan Total Efficiency		
	75%	80%	90%
5	$410	$363	$341
4	328	291	273
3	246	218	205
2	164	145	136
1	82	72	68
0.5	41	36	34
0.4	33	22	27
0.3	25	22	20

Example: A fan handles 30,000 cfm at 2" total pressure, with a total efficiency of 75%. What is the annual saving in energy cost if the total pressure is reduced to 0.5"? From the table, 30 x ($164 – $41) = $3690 per year.

Extremely **low air leakage** from the TITUS terminal units further reduces energy costs to the owner while boosting performance gains. (See the leakage table on the facing page.)

For example: A TITUS 10",1350 cfm unit operating at 1.5" sp downstream has a casing leakage of only four cfm, or less than three tenths of 1%.

For an added benefit, the tight close-off damper in the same 10" unit allows only four cfm of leakage at 1.5" ΔP_S.

The architect can concentrate on design and use of space rather than mechanical restrictions because TITUS terminal units are compact and easily accessible for servicing. Several choices of coil sections, attenuators, and multiple outlets add flexibility.

The engineer, by specifying the TITUS terminal unit, is assured of accurate performance ratings and stable, repeatable cfm settings. The many configurations, accessories, and controls give the engineer considerable scope for problem solving and cost effective innovation.

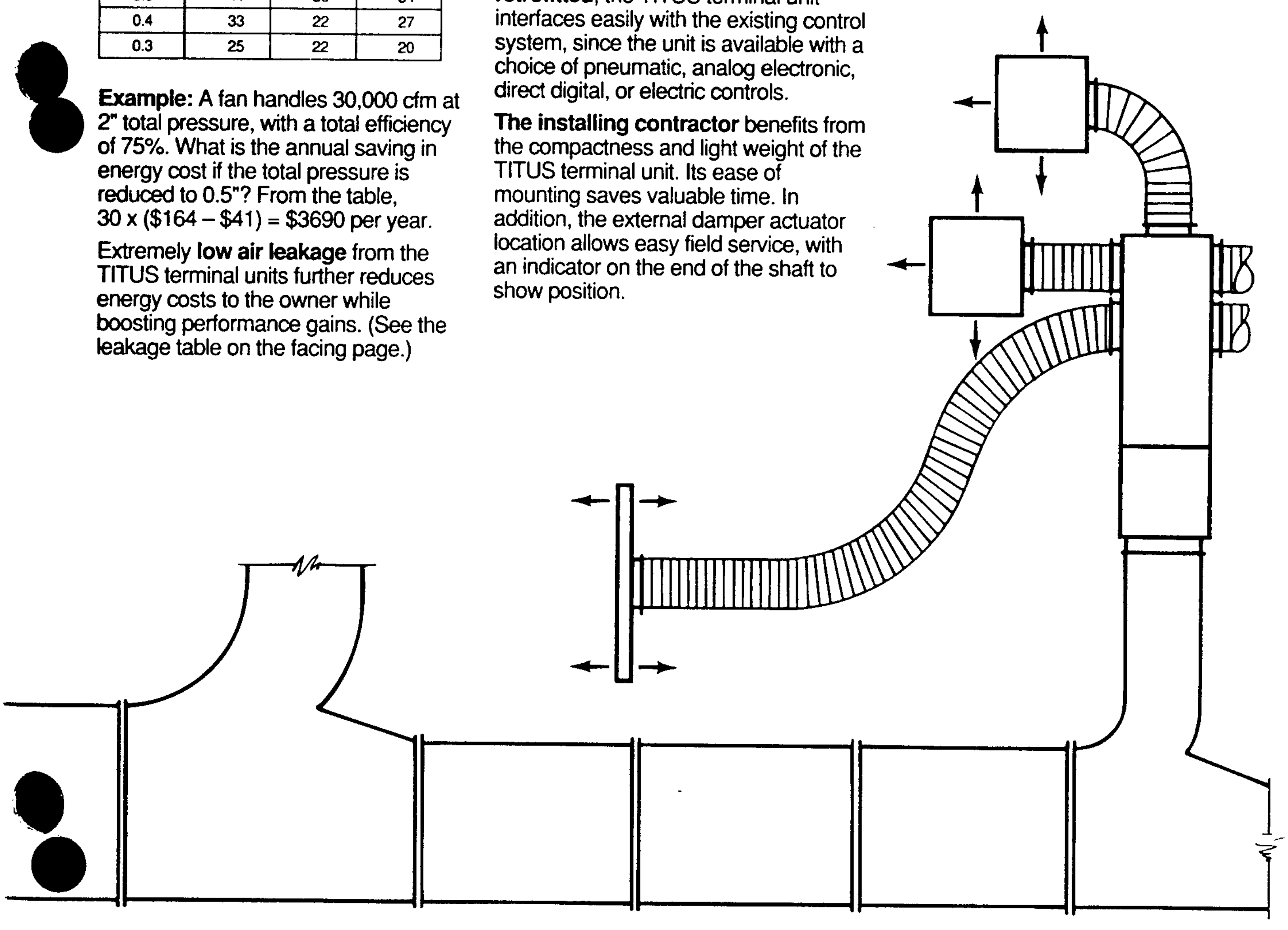
Where an existing building is to be **retrofitted**, the TITUS terminal unit interfaces easily with the existing control system, since the unit is available with a choice of pneumatic, analog electronic, direct digital, or electric controls.

The installing contractor benefits from the compactness and light weight of the TITUS terminal unit. Its ease of mounting saves valuable time. In addition, the external damper actuator location allows easy field service, with an indicator on the end of the shaft to show position.

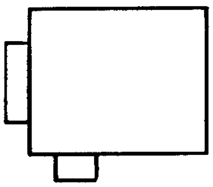
The balancing contractor can work faster because the TITUS terminal unit is an accurate flow measuring station. Convenient gauge taps or meter terminals (depending on the type of control) are built in.

Choose from these basic control types and unit configurations:

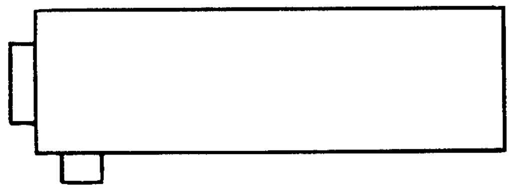
- ▶ Single Duct – Dual Duct
- ▶ Fan powered, constant volume
- ▶ Fan powered, variable volume
- ▶ Retrofit
- ▶ Pneumatic – Electronic – Electric
- ▶ Direct Digital



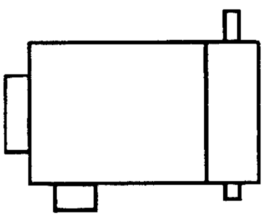
Select a basic terminal unit, add accessory modules to suit the system design.



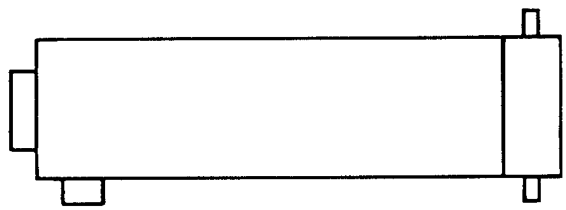
Basic Unit



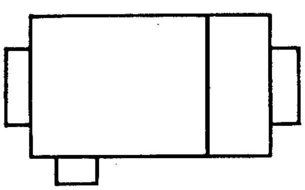
Basic Unit with
Integral Attenuator



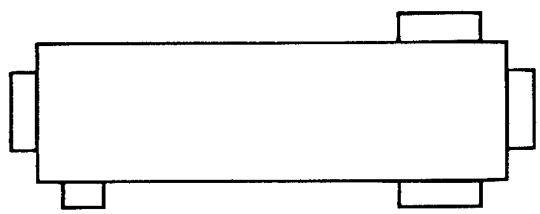
Basic Unit with
Water Coil



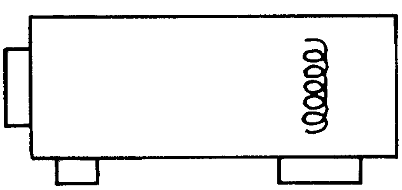
Basic Unit with
Integral Attenuator and Water Coil



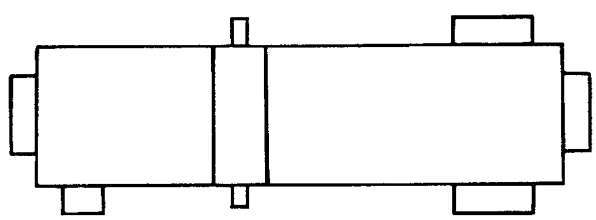
Basic Unit with
Round Discharge



Basic Unit with
Integral Multi-Outlet



Basic Unit with
Electric Coil*



Basic Unit with
Water Coil and Multi-Outlet

*Electric coil not available with ESV pressure dependent terminals.

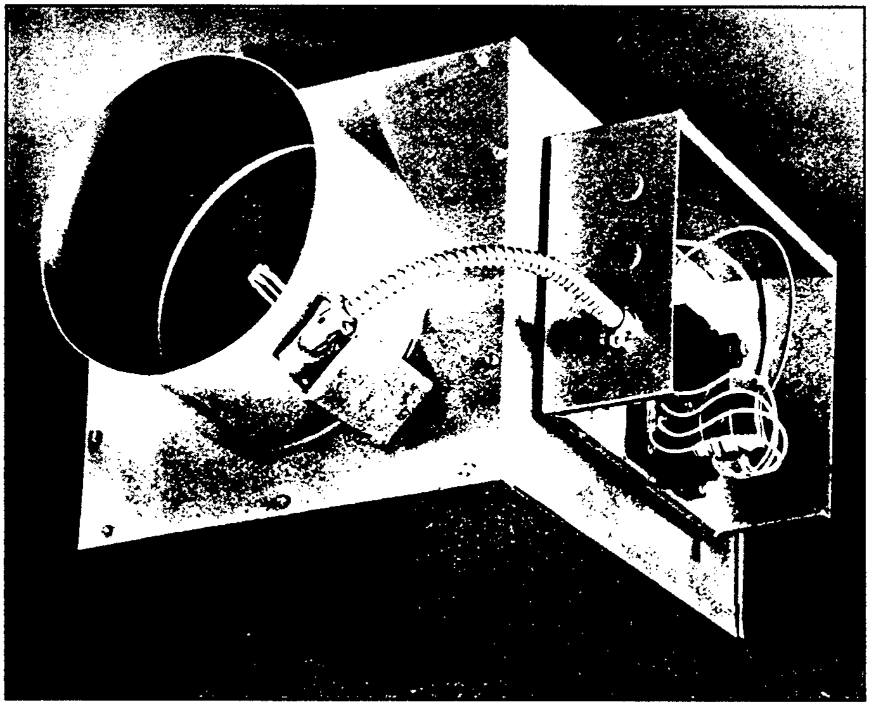
Analog Electronic Units ■ Pressure Independent

Model: AESV

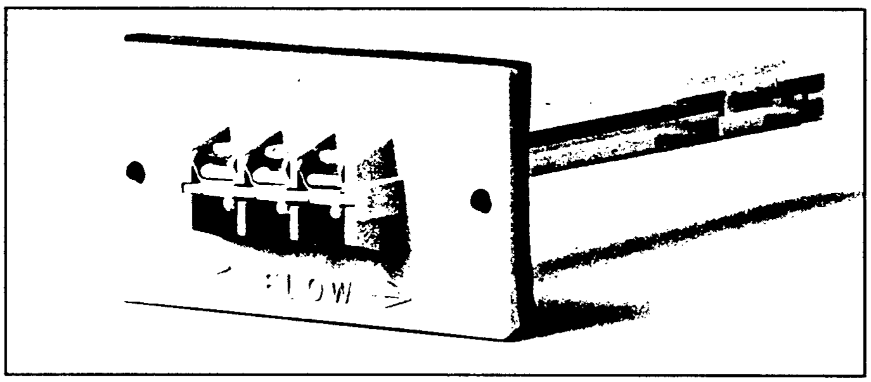
The TITUS Model AESV controls air flow electronically at any duct pressure or temperature that can be expected in a commercial variable air volume system.

The standard electronic velocity sensor, mounted in the inlet of the terminal, is temperature compensated so that there is no difference in calibration over the entire heating and cooling range. The sensor measures only velocity, therefore control of air flow is as accurate at 0.03" of static pressure as at 6".

The optional air flow transducer allows the use of the TITUS multi-point averaging velocity sensor, which averages sampled velocities across the entire terminal inlet. This ensures an accurate velocity signal to the controller even with less than ideal inlet conditions. The transducer is completely solid state with a temperature compensating bridge, and is unaffected by changes in ambient air temperature, inlet air temperature, or position.



Model AESV is shown with control box cover removed.



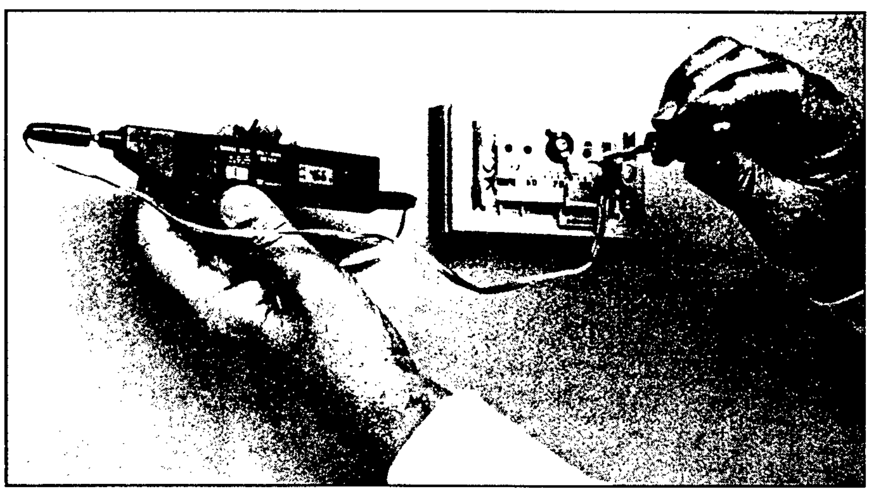
Electronic velocity sensor is temperature compensated.

Air flow rate is adjustable at the room thermostat on the wall.

With the AESV, it is not necessary to climb up into the ceiling space to read and adjust the controller set points. This is accomplished right at the electronic thermostat. Removing the thermostat cover gives access to the adjusting screws and voltmeter jacks.

The electronic thermostat furnished with the unit is one of four types, depending on the application: cooling; heating; cooling with reheat; and cooling-heating. Where required, a 3-stage reheat or automatic changeover relay is factory installed and wired in the control box of the unit.

For a more detailed description of TITUS electronic thermostats, please see pages G16 and G17.



Electronic thermostat has cfm adjustments and voltmeter jacks.

Hot Water and Electric Coils for Single Duct Units

Hot Water Coil

The hot water coil is enclosed in a galvanized steel casing module to match the basic terminal unit. It is factory installed on the terminal discharge as shown on page G6.

▶ Optional on all models of TITUS single duct terminals.

▶ Tubes are 1/2" OD copper.

▶ Connections: Single circuit is 1/2" OD male solder. Multiple circuit is 7/8" OD male solder.

▶ Fins are aluminum, rippled, ten per inch.

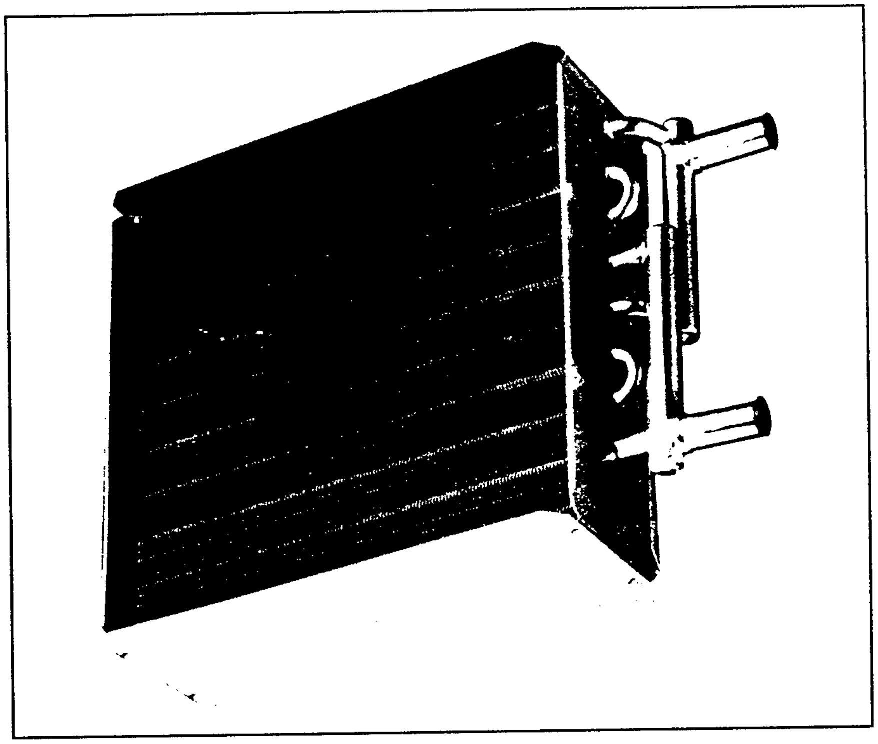
▶ Casing is galvanized steel.

▶ Downstream duct connection is slip and drive cleat.

▶ For capacities, see pages G33-G36.

▶ For dimensions, see page G24.

▶ Water coil valves—pneumatic and electronic are available from TITUS.



Electric Coil

TITUS electric heating coils are designed specifically for use with variable air volume terminals. They are furnished factory mounted in an integral sound attenuator.

▶ Furnished with TITUS Model PESV, AESV, and DESV pressure independent units. Not furnished with pressure dependent units.

▶ Elements are high grade nickel chrome.

▶ 1, 2, or 3 steps of control.

▶ Current characteristics available: 208/240/277 volt, 1 phase, 60 Hertz and 208 or 480 volt, 3 phase, 60 Hertz.

▶ Ratings, dimensions, and additional features, see page G37.

The control panel is an integral part of the coil. The panel mounts on the side of the duct and contains:

▶ Automatic reset thermal cut out.

▶ Secondary protection with replaceable heat limiter.

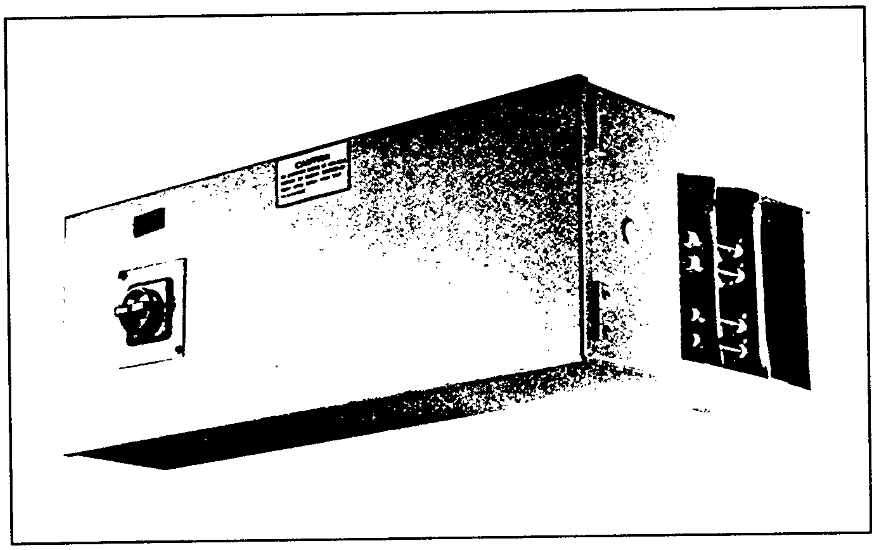
▶ Positive pressure air flow switch.

▶ PE switch for each step of control (pneumatic units).

▶ Magnetic contactor for each step of control (electronic units).

▶ Fuses per NEC (coils over 48 amps).

▶ Optional features, see page G37.

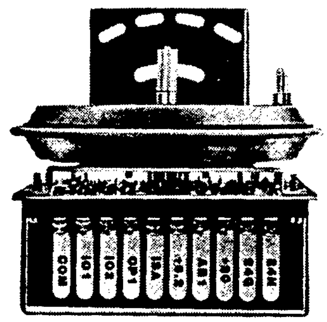


Air Flow Controller/Transmitter

PP-8516

APPLICATION

PP-8516 static or velocity pressure controller is used for central system constant static pressure regulation. The supply air fan output is controlled either by vortex damper or by fan speed control. Continuous static pressure indication or reset to central cooling controller output signal is also provided.



Feb. '95
$245.81

SPECIFICATIONS

Static/Velocity Pressure Setpoint (SPS): Adjustable 0.04 to 6" (1 to 152 mm) W.C., marked 0-100%.
Static/Velocity Pressure Throttling Range: Adjustable 10 to 200% of the static pressure setpoint. Additional T.R. by resistor selection.
Inputs: 0.04 to 6" (1 to 152 mm) W.C. static pressure.
Reset:
- **Slave Input,** 2 to 15 Vdc from master unit.
- **Remote Setpoint,** 0.24 to 3.81 Vdc, to change setpoint from 0 to 100%.

Outputs:
- **Fan or Vortex Damper Control,** 2 thru 15 Vdc @ 12 mA, factory set 6 to 9 Vdc.
- **Indication,** 1 to 11 Vdc @ 2 mA.
- **Master Signal to Slave Units,** 2 thru 15 Vdc.

Power Requirements: 24 Vac @ 3 VA.
Power Supply Available:
- **20 Vdc,** 50 mA.
- **6.2 Vdc,** 4 mA.

Environment:
- **Ambient Temperature Limits,**
  - **Shipping and Storage** -40 to 160°F (-40 to 71°C).
  - **Operating** 40 to 140°F (4 to 60°C).
- **Humidity,** 5 to 95% RH, non-condensing.
- **Locations,** NEMA Type 1 indoor only.

Tap Over Pressure, 50 in. (127 cm) W.C.

Connections: See Figure 1 for designations.
- **Wiring,** Coded screw terminals.
- **Air Pressure Taps,** 2 high and 2 low, barbed for 1/4" O.D. plastic tubing.

Cover: Aluminum.
Mounting: ±15° from horizontal on vertical surface. Avoid locations where high radio frequency or electromagnetic interference generating devices are near.
Dimensions: 4-3/4" high × 4-7/8" wide × 5-7/8" deep (120 mm × 122 mm × 149 mm).

ACCESSORIES

AP-302	Duct static pressure sensing tips for pressure 1" (25.4 mm) W.C. and up
AP-305	Duct static pressure sensing tip for pressure 0.01" (0.3 mm) W.C. and up
ASP-589-060	0 to 6" (0 to 152 mm) W.C. static pressure indication meter, dual scale
AT-8901	Remote setpoint adjuster

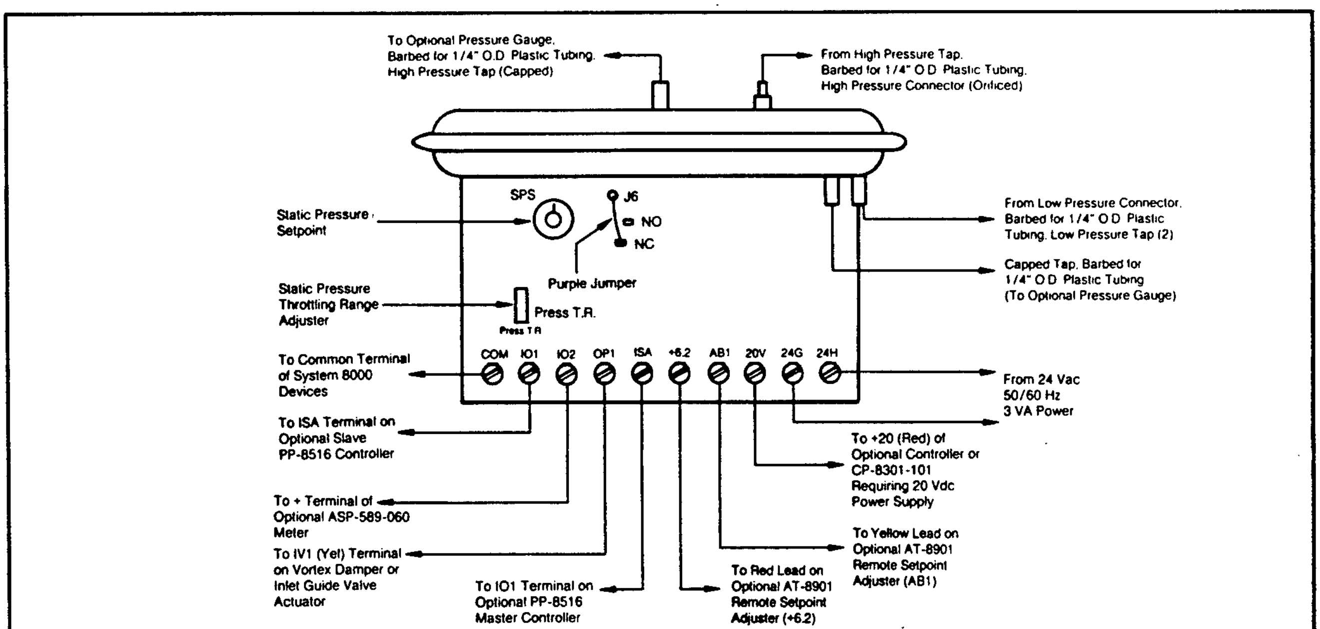
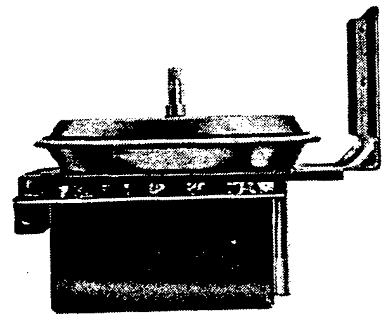


Figure 1. Typical System Wiring and Piping

PP-8121



Feb. '95
$164.97

APPLICATION

PP-8121 controller senses both velocity pressure and space temperature to control pressure for pressure independent air conditioning terminal units for space temperature regulation in Variable Air Volume Air Distribution Systems. Continuous velocity pressure indication output signal also provided.

SPECIFICATIONS

General: The terminal unit is controlled to maintain a set space temperature independent of up-stream static or velocity pressure. The setpoint of the airflow controller is reset to increase or decrease the airflow (CFM) from the terminal unit to maintain the temperature at setpoint when the space temperature drifts from the setpoint.
Temperature Setpoint (SPA): Adjustable 41 to 95°F (5 to 35°C).
Airflow Setpoint (SPS): Adjustable 0 to 100%, 0.01 to 1.5" (0.25 to 38.1 mm) W.C.; factory set at midrange for the terminal unit size in the range of 0.01 to 1.5" (0.25 to 38.1 mm) W.C. [400 to 4800 ft./min. (2.03 to 24.38 m/s) at 70°F (21°C)].
High Flow Limit: Adjustable 0 to 100%.
Low Flow Limit: Adjustable 0 to 100%.
Air Conditioning Terminal Unit Airflow Range: 100 thru 5000 CFM.
Inputs:
- **Velocity Pressure,** 0.01 to 1.5" (0.25 to 38.1 mm), W.C. [400 to 4800 ft./min. (2.03 to 24.38 m/s) at 70°F (21°C)].
- **Temperature Sensor,** 1000 ohm Balco, typically TS-8101 or TS-8111.

Reset:
- **Pressure Control,** 1 to 11 Vdc.
- **Temperature Control,** 2 to 15 Vdc.
- **Remote Setpoint,** AT-8000 series, typically AT-8158.

Outputs:
- **Damper Control,** 2 thru 15 Vdc at 12 mA, D.A. or R.A.
- **Indication,** 1 to 11 Vdc at 2 mA.
- **Other Controlled Devices,** 2 thru 15 Vdc at 12 mA.

Throttling Range:
- **Temperature,** 3, 6, 9°F (2, 3, 5°C), by jumper; factory set at 3°F (2°C).
- **Pressure,** 10 to 200%, factory set at 63%.

Power Requirements: 24 Vac @ 3 VA.
Power Supply Available: 20 Vdc @ 50 mA; 6.4 Vdc @ 4 mA.
Environment:
- **Ambient Temperature Limits,**
  - **Shipping and Storage** -40 to 160°F (-40 to 71°C).
  - **Operating** 40 to 140°F (4 to 60°C).
- **Humidity,** 5 to 95% RH, non-condensing.
- **Locations,** NEMA Type 1 indoor only.

Tap Over Pressure, 15 in. (381 mm) W.C.
Connections: See Figure 1 for designations.
- **Wiring,** Coded screw terminals.
- **Air Pressure Taps,** 2 high and 2 low, barbed fittings for 1/4" O.D. plastic tubing.

Cover: Aluminum.
Mounting: ±15° from horizontal on vertical surface. Avoid locations where high radio frequency or electromagnetic interference generating devices are near.

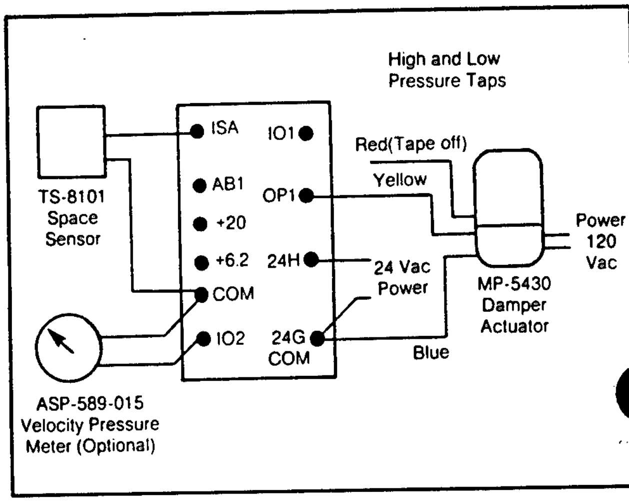


Figure 1. Typical Wiring PP-8121 Terminal Unit Control

Dimensions: 4-3/4" high × 4-7/8" wide × 5-7/8" deep (120 mm × 122 mm × 149 mm).
Velocity Pressure Sensor: Flow stations which provide traverse and averaging results are recommended. The PP-8000 series are usable with air station pickups; orifice rings and other pressure sensors available from other manufacturers.

ACCESSORIES

AP-305	Duct static pressure sensing tip for pressure 0.01" (0.25 mm) and up
ASP-589-015	0 to 1-1/2" (0 to 3.8 cm) W.C. velocity pressure indication meter.
AT-8158	Remote setpoint adjuster, dual scale 55 to 85°F (13 to 29°C)
AT-8258-101	Night setback scale for AT-8158
AT-8901	Remote setpoint adjuster
CC-8101	Electronic single stage relay
TP-8101	Room temperature controller
TP-8124	Room temperature controller/dual setpoints
TS-8101	Room sensor
TS-8111	Room sensor with setpoint
TS-8241	Diffuser sensor
TS-8261	Light fixture sensor
TS-8501	Outdoor sensor
TS-8601	Selective ratio discharge sensor

E M C ENGINEERS, INC.
2750 S. Wadsworth Blvd.
Suite C-200
Denver, CO 80227
(303) 988-2951

9755 Dogwood Rd.
Suite 220
Roswell, GA 30075
(404) 642-1864

JOB 1406.005 HVAC Upgrade Ft Riley, KS.
SHEET NO. ______ OF ______
CALCULATED BY C. Wohlert DATE 3/15/95
CHECKED BY ______ DATE ______
SCALE ______

BARBER-COLEMAN CONTROLS

Reed Shoemarker Barber colman Price Quote for controls

- DDC Micro net w/ Built in actuator (VAV Box controller) $230
  \+ Pressure probe for each Box $40 } $270/Box

- for static pressure transducer (PP-8311) = $200

- Electric VAV Box controller $160.00

- AHU controller $245.00

BUILDING 222
ANNUAL ENERGY SAVINGS SUMMARY

Item	Baseline	ECO	Annual Energy Savings	Adj. Annual Energy Savings*
Annual Electric (MBTU)	563.48	303.54	259.94	259.94
Annual Natural Gas (MBTU)	200.97	327.96	-126.99	-126.99
Electric Demand June (KW)	37.86	26.34	11.52	11.52
Electric Demand July (KW)	46.42	33.73	12.70	12.70
Electric Demand August (KW)	45.10	29.17	15.92	15.92

*Energy savings prorated on a square foot basis:

Baseline Model Bldg 222B (sq.ft.)	8412
ECO Model Bldg 222B (sq.ft.)	8412
Square Footage Adjustment Factor	1.000

LIFE CYCLE COST ANALYSIS SUMMARY

ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

LOCATION:	Fort Riley	REGION: 2 (Kansas)		PROJECT NO:	1406-005
PROJECT TITLE:	Feasibility Study for HVAC Upgrade			FISCAL YEAR:	1995
ANALYSIS DATE:	05/04/95	ECONOMIC LIFE:	20	PREPARED BY:	C. Wohlert

1. INVESTMENT: **BLDG 222 - Replace SZ AHU w/ VAV AHU**

A.	CONSTRUCTION COST	=	$28,530	
B.	SIOH COST	(5.5% of 1A) =	$1,569	
C.	DESIGN COST	(6.0% of 1A) =	$1,712	
D.	TOTAL COST	(1A +1B +1C) =	$31,811	
E.	SALVAGE VALUE OF EXISTING EQUIPMENT =		$0	
F.	PUBLIC UTILITY COMPANY REBATE =		$0	
G.	TOTAL INVESTMENT	(1D -1E -1F) =	------->	$31,811

2. ENERGY SAVINGS (+) OR COST (-):

DATE OF NISTR 85-3273-9 USED FOR DISCOUNT FACTORS: JAN '95

	ENERGY SOURCE	FUEL COST $/MBTU (1)	SAVINGS MBTU/YR (2)	ANNUAL $ SAVINGS (3)	DISCOUNT FACTOR (4)	DISCOUNTED SAVINGS (5)	
A.	ELECT.	$12.10	260	$3,145	15.88	$49,947	
B.	DIST	$0.00	0	$0	19.16	$0	
C.	NAT GAS	$4.12	(127)	($523)	18.30	($9,575)	
D.	COAL	$0.00	0	$0	16.62	$0	
E.	ELEC. DEMAND			$809	14.88	$12,042	
F.	TOTAL		133	$3,431		-------->	$52,415

3. NON-ENERGY SAVINGS (+) OR COST (-)

A. ANNUAL RECURRING (+/-)

1 ANNUAL MAINTENANCE	$0	14.88	$0
2	$0	14.88	$0
3	$0	14.88	$0
4 TOTAL ANNUAL DISC. SAVINGS (+) / COST	$0		$0

B. NON-RECURRING (+/-)

ITEM	SAVINGS (+) COST(-) (1)	YEAR OF OCCURRENCE (2)	DISCOUNT FACTOR (3) (TABLE A-2)	DISCOUNTED SAVINGS/COST (4)
a. BASELINE EQUIP. REPLCMNT.	$14,214	5	0.863	$12,267
b.				$0
c.				$0
d.				$0
e.				$0
f. TOTAL	$14,214			$12,267

C. TOTAL NON-ENERGY DISCOUNTED SAVINGS (+) OR COST (-) (3A4 + 3Bf4) = $12,267

4.	FIRST YEAR DOLLAR SAVINGS (+) / COSTS (-)	(2F3+3A4+(3Bf1/Economic Life))	$4,142
5.	SIMPLE PAYBACK (SPB) IN YEARS (MUST BE < 10 YEARS TO QUALIFY)	(1G/4) =	7.68
6.	TOTAL NET DISCOUNTED SAVINGS	(2F5 + 3C) =	$64,681
7.	DISCOUNTED SAVINGS-TO-INVESTMENT RATIO (SIR) (MUST HAVE SIR > 1.25 TO QUALIFY)	(6/1G) =	2.03

ENGINEER'S OPINION OF PROBABLE COST

PROJECT	Fort Riley Feasibility Study for HVAC Upgrade	**SHEET**	1 OF 1
ENGINEER	E M C Engineers, Inc.	**DATE PREPARED**	4-May-95
	Denver, CO	**ESTIMATOR**	C. Wohlert
		CHECKED BY	A. Niemeyer

Line No.	Item Refer Code	Item Description	Unit of Measure	MATERIAL COST Quantity	MATERIAL COST Unit Cost	MATERIAL COST Total	LABOR COST Crew/ Worker	LABOR COST Hours/ Unit	LABOR COST Total	TOTAL
1		**BUILDING 222**								
2		**PROPOSED SYSTEM MODIFICATIONS**								
3										
4		*NEW SYSTEMS INSTALLATION*								
5	AHU8000	8,000 CFM AHU, COOLING ONLY	EA.	1.0	$4,433.18	$4,433	Q-6	40	$804	$5,237
6	VSD15	VARIABLE SPEED DRIVE W/ CONTRLER,15HP	EA.	1.0	$4,060.11	$4,060	1-ELEC	19	$398	$4,458
7	REHEAT3	REHEAT COIL, 2ROW, 3'x1'	EA.	2.0	$154.07	$308	Q-5	1.32	$51	$359
8	STLPIP1	STEEL PIPE SCH. 40, 1" W/HANGERS	L.F.	120.0	$2.10	$252	Q-1	0.151	$351	$604
9	STLPIP2.5	STEEL PIPE SCH. 40, 2.5" W/HANGERS	L.F.	25.0	$5.28	$132	Q-15	0.34	$165	$297
10		FITTINGS ADD 5%			$0.37				$25.81	$26
11	CNTV2.5	CONTROL VALVE 2-1/2"	EA.	1.0	$935.09	$935	1-PLUM	3.556	$77	$1,012
12	CNTV1	CONTROL VALVE 1"	EA.	2.0	$190.89	$382	1-PLUM	0.471	$20	$402
13	INSLPIP1	1" FIBERGLASS PIPE INSULATION, 1" THCK	L.F.	12.5	$0.62	$8	Q-14	0.073	$17	$25
14	INSLPIP2.5	2.5" FIBERGLASS PIPE INSULATION, 1.5" THCK	L.F.	0.0	$1.60	$0	Q-14	0.089	$0	$0
15	DUCT1000	GAL. STEEL DUCTWORK, 500 TO 1000 LB.	LB.	1010.0	$0.47	$470	Q-10	0.094	$1,845	$2,314
16	E-TSTAT1	SINGLE SETPOINT ELEC. TSTAT, 3 WIRE	EA.	2.0	$24.23	$48	1-ELEC	0.8	$33	$82
17	WIRE#12	COPPER WIRING #12	C.L.F.	1.5	$7.41	$11	1-ELEC	0.727	$23	$34
18	12"RDUCT	12 IN. DIA. ROUND DUCT, GAL. STL	L.F.	60.0	$2.73	$164	Q-9	0.133	$150	$314
19	9X9DIFF	9X9 SA DIFFUSERS	EA.	8.0	$56.69	$453	1-SHEE	0.571	$95	$549
20	VAVBX35	VAV BOX, 3500 CFM, ELEC	EA.	2.0	$310.08	$620	1-SHEE	1.48	$62	$682
21	DTINSL1"	DUCT INSLULATION, 1" THICK	S.F.	1010.0	$0.48	$489	Q-14	0.046	$856	$1,345
22										
23										
24										
25		*EXISTING SYSTEMS DEMOLITION*								
26		AHU	TON	1.9			Q-5	17.778	$638	$638
27		DUCT	TON	0.4			Q-5	17.778	$129	$129
28										
29										
30										
31		**SUBTOTAL**				$12,767			$5,738	$18,505
32	OH	OVERHEAD			17%	$2,145			$964	$3,109
33	PRO	PROFIT			10%	$1,491			$670	$2,161
34	CONT	CONTINGENCY			20%	$3,281			$1,475	$4,755
35	**TOTAL COST**		-	-	-	$19,683	-	-	$8,847	$28,530

ENGINEER'S OPINION OF PROBABLE COST

PROJECT	Fort Riley Feasibility Study for HVAC Upgrade	**SHEET** 1	**OF** 1
ENGINEER	E M C Engineers, Inc.	**DATE PREPARED**	4-May-95
	Denver, CO	**ESTIMATOR**	C. Wohlert
		CHECKED BY	A. Niemeyer

Line No.	Item Refer Code	Item Description	Unit of Measure	MATERIAL COST Quantity	MATERIAL COST Unit Cost	MATERIAL COST Total	LABOR COST Crew/ Worker	LABOR COST Hours/ Unit	LABOR COST Total	TOTAL
1		**BUILDING 222**								
2		**NON-RECURRING**								
3										
4		*EXISTING SYSTEM REPLACEMENT*								
5	AHUH8000	8,000 CFM AHU	EA.	1.0	$5,319.81	$5,320	Q-6	42	$844	$6,164
6	STLPIP2.5	STEEL PIPE SCH. 40, 2.5" W/HANGERS	L.F.	25.0	$5.28	$132	Q-15	0.34	$165	$297
7		FITTINGS ADD 5%			$0.26				$8.24	$8
8	INSLPIP2.5	2.5" FIBERGLASS PIPE INSULATION, 1.5" THCK	L.F.	25.0	$1.60	$40	Q-14	0.089	$41	$81
9	DUCT200	GAL. STEEL DUCTWORK, UNDER 200 LB.	LB.	125.0	$1.51	$189	Q-10	0.102	$248	$437
10	CNTV2.5	CONTROL VALVE 2-1/2"	EA.	1.0	$935.09	$935	1-PLUM	3.556	$77	$1,012
11	CNTV2	CONTROL VALVE 2"	EA.	1.0	$397.29	$397	1-PLUM	0.889	$19	$416
12	DTINSL1"	DUCT INSULATION, 1" THICK	S.F.	125.0	$0.48	$61	Q-14	0.046	$106	$166
13										
14										
15										
16										
17										
18										
19										
20		*EXISTING SYSTEMS DEMOLITION*								
21		AHU	TON	1.9			Q-5	17.778	$638	$638
22										
23										
24										
25										
26										
27										
28										
29										
30										
31		**SUBTOTAL**				$7,074			$2,146	$9,219
32	OH	OVERHEAD			17%	$1,188			$360	$1,549
33	PRO	PROFIT			10%	$826			$251	$1,077
34	CONT	CONTINGENCY			20%	$1,818			$551	$2,369
35	**TOTAL COST**		-	-	-	$10,906	-	-	$3,308	$14,214

ENGINEER'S OPINION OF PROBABLE COST

PROJECT	Fort Riley Feasibility Study for HVAC Upgrade	**SHEET**	1 **OF** 1
ENGINEER	E M C Engineers, Inc.	**DATE PREPARED**	4-May-95
	Denver, CO	**ESTIMATOR**	C. Wohlert
		CHECKED BY	A. Niemeyer

Line No.	Item Refer Code	Item Description	Unit of Measure	MATERIAL COST Quantity	MATERIAL COST Unit Cost	MATERIAL COST Total	LABOR COST Crew/ Worker	LABOR COST Hours/ Unit	LABOR COST Total	TOTAL
1		**BUILDING 222**								
2		***ANNUAL RECURRING***								
3		***ANNUAL MAINTENANCE COST - BASELINE***								
4										
5										
6										
7										
8										
9										
10										
11										
12										
13										
14										
15	**TOTAL ANNUAL MAINTENANCE COST - BASELINE**		-	-	-	$0	-	-	$0	$0
16										
17		***ANNUAL MAINTENANCE COST - NEW HVAC REPLACEMENT***								
18										
19										
20										
21										
22										
23										
24										
25										
26										
27										
28										
29	**TOTAL ANNUAL MAINTENANCE COST - BASELINE**		-	-	-	$0	-	-	$0	$0
30										
31										
32										
33										
34										
35	**TOTAL ANNUAL MAINTENANCE COST SAVINGS**		-	-	-	$0	-	-	$0	$0

DEMAND LIMITING ANALYSIS BUILDING 222

SUMMER PEAK (KW) = 27812	1993 JUL BILL 7/1-8/2 ACTUAL	1993 AUG BILL 8/2-9/1 ACTUAL	1993 SEP BILL 9/3-10/1 ACTUAL	1993 OCT BILL 10/1-11/1 ACTUAL	1993 NOV BILL 11/1-12/1 ACTUAL	1993 DEC BILL 12/1-1/3 ACTUAL	1993 JAN BILL 1/4-2/1 ACTUAL	1993 FEB BILL 2/1-3/1 ACTUAL	1993 MAR BILL 3/3-4/1 ACTUAL	1993 APR BILL 4/1-5/3 ACTUAL	1993 MAY BILL 5/3-6/1 ACTUAL	1993 JUN BILL 6/1-7/1 ACTUAL
BASE CASE												
CAPACITY (KW)	32472	34452	26136	20754	26400	22752	27108	25812	23310	21834	21996	30096
POWER FACTOR (%)	99.20%	99.10%	99.10%	99.90%	99.80%	99.70%	99.50%	99.60%	99.60%	99.80%	99.60%	98.80%
CAPACITY (KVA)	32734	34765	26373	20775	26453	22820	27244	25916	23404	21878	22084	30462
80% SUMMER PEAK (KVA)	27812	27812	27812	27812	27812	27812	27812	27812	27812	27812	27812	27812
CONTRACT MINIMUM (KVA)	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643
BILLING CAPACITY (KVA)	32734	34765	27812	27812	27812	27812	27812	27812	27812	27812	27812	30462
ACTUAL OR 80% PEAK	ACTUAL	ACTUAL	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	ACTUAL
200 KVA @ $4.45	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00
NEXT 400 @ $4.25	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00
REMAINING @ $4.05	$130,142.18	$138,367.78	$110,208.22	$110,208.22	$110,208.22	$110,208.22	$110,208.22	$110,208.22	$110,208.22	$110,208.22	$110,208.22	$120,939.23
SUB DISCOUNT $.20	($6,546.77)	($6,952.98)	($5,562.38)	($5,562.38)	($5,562.38)	($5,562.38)	($5,562.38)	($5,562.38)	($5,562.38)	($5,562.38)	($5,562.38)	($6,092.31)
CAPACITY CHARGE	$126,185.40	$134,004.80	$107,235.84	$107,235.84	$107,235.84	$107,235.84	$107,235.84	$107,235.84	$107,235.84	$107,235.84	$107,235.84	$117,436.92
TOTAL ENERGY (KWH)	16,920,000	16,200,000	10,980,000	10,140,000	11,160,000	12,930,000	12,600,000	12,270,000	12,480,000	11,070,000	9,720,000	13,170,000
50*KVA @ $.03924	$64,223.85	$68,208.70	$54,566.96	$54,566.96	$54,566.96	$54,566.96	$54,566.96	$54,566.96	$54,566.96	$54,566.96	$54,566.96	$59,765.54
100*KVA @ $.03404	$111,426.10	$118,339.66	$94,671.73	$94,671.73	$94,671.73	$94,671.73	$94,671.73	$94,671.73	$94,671.73	$94,671.73	$94,671.73	$103,691.08
250*KVA @ $.03084	$252,378.15	$268,037.26	$209,965.32	$184,059.72	$214,429.80	$214,429.80	$214,429.80	$214,429.80	$214,429.80	$212,740.92	$171,106.92	$234,858.46
EXCESS @ $.02864	$109,589.57	$65,701.49	$0.00	$0.00	$1,009.19	$51,701.99	$42,250.79	$32,799.59	$38,813.99	$0.00	$0.00	$28,221.42
ENERGY CHARGE	$537,617.67	$520,287.11	$359,204.01	$333,298.41	$364,677.69	$415,370.49	$405,919.29	$396,468.09	$402,482.49	$361,979.61	$320,345.61	$426,536.49
TOTAL CHARGE LESS ECA	$663,803.07	$654,291.92	$466,439.85	$440,534.25	$471,913.53	$522,606.33	$513,155.13	$503,703.93	$509,718.33	$469,215.45	$427,581.45	$543,973.42
DEMAND REDUCTION (KW)	**12.70**	**15.92**	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**11.52**
CAPACITY (KW)	32459	34436	26136	20754	26400	22752	27108	25812	23310	21834	21996	30084
POWER FACTOR (%)	99.20%	99.10%	99.10%	99.90%	99.80%	99.70%	99.50%	99.60%	99.60%	99.80%	99.60%	98.80%
CAPACITY (KVA)	32721	34749	26373	20775	26453	22820	27244	25916	23404	21878	22084	30450
80% SUMMER PEAK (KVA)	27799	27799	27799	27799	27799	27799	27799	27799	27799	27799	27799	27799
CONTRACT MINIMUM (KVA)	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643
BILLING CAPACITY (KVA)	32721	34749	27799	27799	27799	27799	27799	27799	27799	27799	27799	30450
ACTUAL OR 80% PEAK	ACTUAL	ACTUAL	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	ACTUAL
200 KVA @ $4.45	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00
NEXT 400 @ $4.25	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00
REMAINING @ $4.05	$130,090.33	$138,302.70	$110,156.16	$110,156.16	$110,156.16	$110,156.16	$110,156.16	$110,156.16	$110,156.16	$110,156.16	$110,156.16	$120,892.02
SUB DISCOUNT $.20	($6,544.21)	($6,949.76)	($5,559.81)	($5,559.81)	($5,559.81)	($5,559.81)	($5,559.81)	($5,559.81)	($5,559.81)	($5,559.81)	($5,559.81)	($6,089.98)
CAPACITY CHARGE	$126,136.12	$133,942.94	$107,186.35	$107,186.35	$107,186.35	$107,186.35	$107,186.35	$107,186.35	$107,186.35	$107,186.35	$107,186.35	$117,392.04
TOTAL ENERGY (KWH)	16,920,000	16,200,000	10,980,000	10,140,000	11,160,000	12,930,000	12,600,000	12,270,000	12,480,000	11,070,000	9,720,000	13,170,000
50*KVA @ $.03924	$64,198.74	$68,177.18	$54,541.74	$54,541.74	$54,541.74	$54,541.74	$54,541.74	$54,541.74	$54,541.74	$54,541.74	$54,541.74	$59,742.67
100*KVA @ $.03404	$111,382.52	$118,284.97	$94,627.97	$94,627.97	$94,627.97	$94,627.97	$94,627.97	$94,627.97	$94,627.97	$94,627.97	$94,627.97	$103,651.39
250*KVA @ $.03084	$252,279.45	$267,913.37	$210,024.78	$184,119.18	$214,330.69	$214,330.69	$214,330.69	$214,330.69	$214,330.69	$212,800.38	$171,166.38	$234,768.58
EXCESS @ $.02864	$109,736.22	'$65,885.57	$0.00	$0.00	$1,156.46	$51,849.26	$42,398.06	$32,946.86	$38,961.26	$0.00	$0.00	$28,354.97
ENERGY CHARGE	$537,596.93	$520,261.08	$359,194.50	$333,288.90	$364,656.86	$415,349.66	$405,898.46	$396,447.26	$402,461.66	$361,970.10	$320,336.10	$426,517.61
TOTAL CHARGE LESS ECA	$663,733.05	$654,204.02	$466,380.85	$440,475.25	$471,843.22	$522,536.02	$513,084.82	$503,633.62	$509,648.02	$469,156.45	$427,522.45	$543,909.65
SUMMARY												
MONTHLY DIFFERENCE	$70.02	$87.90	$59.00	$59.00	$70.32	$70.32	$70.32	$70.32	$70.32	$59.00	$59.00	$63.77
ANNUAL DIFFERENCE.............		**$809.29**										

NUMBER OF EXTERIOR SURFACES 8 RECTANGULAR 8 OTHER 0
(U-VALUE INCLUDES INSIDE AIR FILM PLUS OUTSIDE AIR FILM AT 7.5 MPH WINDSPEED)

SURFACE	SPACE	- - - - G L A S S - - - - U-VALUE (BTU/HR-SQFT-F)	AREA (SQFT)	- - - - W A L L - - - - U-VALUE (BTU/HR-SQFT-F)	AREA (SQFT)	- W A L L + G L A S S - U-VALUE (BTU/HR-SQFT-F)	AREA (SQFT)	AZIMUTH
	LIQUOR-STR	0.619	148.50	0.231	161.50	0.417	310.00	EAST
	OFFIC-AREA	0.799	134.25	0.231	855.75	0.308	990.00	EAST
	LIQ-STORAG	1.021	54.00	0.231	476.00	0.311	530.00	WEST
	LIQUOR-STR	1.021	12.00	0.231	428.00	0.252	440.00	WEST
	OFFIC-AREA	1.021	18.00	0.231	312.00	0.274	330.00	WEST
	LIQUOR-STR	0.000	0.00	0.067	2411.50	0.067	2411.50	ROOF
	LIQ-STORAG	0.000	0.00	0.067	1377.00	0.067	1377.00	ROOF
	OFFIC-AREA	0.000	0.00	0.067	4620.00	0.067	4620.00	ROOF
	LIQUOR-STR	0.000	0.00	0.020	2411.50	0.020	2411.50	UNDERGRND
	LIQ-STORAG	0.000	0.00	0.020	1377.00	0.020	1377.00	UNDERGRND
	OFFIC-AREA	0.000	0.00	0.020	4620.00	0.020	4620.00	UNDERGRND

EMC ENGINEERS INC. EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/17/1995 15:22:48 LDL RUN 1
DENVER, CO 80227 EXISTING CONDITION OF BLDG 222 LIQUOR STORE AND TRAINING AREA
REPORT- LV-D DETAILS OF EXTERIOR SURFACES IN THE PROJECT TOPEKA, KS

	AVERAGE U-VALUE/GLASS (BTU/HR-SQFT-F)	AVERAGE U-VALUE/WALLS (BTU/HR-SQFT-F)	AVERAGE U-VALUE WALLS+GLASS (BTU/HR-SQFT-F)	GLASS AREA (SQFT)	OPAQUE AREA (SQFT)	GLASS+OPAQUE AREA (SQFT)
EAST	0.704	0.231	0.334	282.75	1017.25	1300.00
WEST	1.021	0.231	0.282	84.00	1216.00	1300.00
ROOF	0.000	0.067	0.067	0.00	8408.50	8408.50
ALL WALLS	0.777	0.231	0.308	366.75	2233.25	2600.00
WALLS+ROOFS	0.777	0.101	0.124	366.75	10641.75	11008.50
UNDERGRND	0.000	0.020	0.020	0.00	8408.50	8408.50
BUILDING	0.777	0.065	0.079	366.75	19050.25	19417.00

EMC ENGINEERS INC. EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/17/1995 15:22:48 LDL RUN 1
DENVER, CO 80227 EXISTING CONDITION OF BLDG 222 LIQUOR STORE AND TRAINING AREA
REPORT- LS-C BUILDING PEAK LOAD COMPONENTS TOPEKA, KS

*** BUILDING ***

FLOOR AREA	8412	SQFT	781	SQMT
VOLUME	84120	CUFT	2382	CUMT

	COOLING LOAD				HEATING LOAD	
TIME	AUG 11	4PM			JAN 5	6AM
DRY-BULB TEMP	100F	38C			2F	-17C
WET-BULB TEMP	71F	22C			1F	-17C

	SENSIBLE (KBTU/H)	SENSIBLE (KW)	LATENT (KBTU/H)	LATENT (KW)	HEATING SENSIBLE (KBTU/H)	HEATING SENSIBLE (KW)
WALLS	6.351	1.860	0.000	0.000	-30.240	-8.857
ROOFS	41.676	12.206	0.000	0.000	-43.122	-12.629
GLASS CONDUCTION	5.916	1.733	0.000	0.000	-21.846	-6.398
GLASS SOLAR	13.015	3.812	0.000	0.000	0.790	0.231
DOOR	0.000	0.000	0.000	0.000	0.000	0.000
INTERNAL SURFACES	0.000	0.000	0.000	0.000	0.000	0.000
UNDERGROUND SURFACES	-0.796	-0.233	0.000	0.000	-4.828	-1.414
OCCUPANTS TO SPACE	10.432	3.055	18.594	5.446	0.258	0.076
LIGHT TO SPACE	32.061	9.390	0.000	0.000	1.578	0.462
EQUIPMENT TO SPACE	1.502	0.440	0.000	0.000	0.122	0.036
PROCESS TO SPACE	0.000	0.000	0.000	0.000	0.000	0.000
INFILTRATION	3.605	1.056	0.495	0.145	-9.612	-2.815
TOTAL	113.762	33.318	19.089	5.591	-106.899	-31.308
TOTAL LOAD	132.851 KBTU/H		38.909 KW		-106.899 KBTU/H	-31.308 KW
TOTAL LOAD / AREA	15.79BTU/H.SQFT		49.787 W /SQMT		12.708BTU/H.SQFT	40.062 W /SQMT

NOTE
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1) THE ABOVE LOADS EXCLUDE OUTSIDE VENTILATION AIR LOADS
2) TIMES GIVEN IN STANDARD TIME FOR THE LOCATION IN CONSIDERATION

EMC ENGINEERS INC. EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/17/1995 15:22:48 SDL RUN 1
DENVER, CO 80227 EXISTING CONDITION OF BLDG 222 LIQUOR STORE AND TRAINING AREA
REPORT- SS-A SYSTEM MONTHLY LOADS SUMMARY FOR EXIST-SZ TOPEKA, KS

	COOLING						HEATING						ELEC	
MONTH	COOLING ENERGY (MBTU)	TIME OF MAX DY	HR	DRY-BULB TEMP	WET-BULB TEMP	MAXIMUM COOLING LOAD (KBTU/HR)	HEATING ENERGY (MBTU)	TIME OF MAX DY	HR	DRY-BULB TEMP	WET-BULB TEMP	MAXIMUM HEATING LOAD (KBTU/HR)	ELEC-TRICAL ENERGY (KWH)	MAXIMUM ELEC LOAD (KW)
JAN	0.00000					0.000	-41.257	5	6	2.F	1.F	-130.471	10749.	19.486
FEB	0.00000					0.000	-26.324	3	8	-2.F	-3.F	-128.690	10065.	19.486
MAR	0.00000					0.000	-15.901	3	8	15.F	12.F	-104.184	10827.	19.486
APR	0.00000					0.000	-2.942	5	7	30.F	27.F	-64.762	10557.	19.486
MAY	34.04383	16	2	62.F	59.F	411.602	-0.252	5	21	56.F	51.F	-5.173	10788.	19.486
JUN	68.72543	28	18	89.F	76.F	188.508	0.000					0.000	10562.	19.486
JUL	82.82845	23	17	97.F	79.F	205.198	0.000					0.000	10837.	19.486
AUG	80.37974	23	16	96.F	77.F	193.622	0.000					0.000	10774.	19.486
SEP	51.19699	8	18	89.F	72.F	163.082	0.000					0.000	10596.	19.486
OCT	0.74884	1	18	83.F	68.F	87.138	-1.288	2	3	59.F	56.F	-46.899	10783.	19.486
NOV	0.00000					0.000	-11.923	3	7	19.F	17.F	-90.120	10523.	19.486
DEC	0.00000					0.000	-34.444	6	7	15.F	12.F	-104.639	10857.	19.486
TOTAL	317.923						-134.332						127914.	
MAX						411.602						-130.471		19.486

D1-9

EMC ENGINEERS INC. EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/17/1995 15:22:48 SDL RUN 1
DENVER, CO 80227 EXISTING CONDITION OF BLDG 222 LIQUOR STORE AND TRAINING AREA
REPORT- SS-C SYSTEM MONTHLY LOAD HOURS FOR EXIST-SZ TOPEKA, KS

	NUMBER OF HOURS										COINCIDENT LOADS	
MONTH	HOURS COOLING LOAD	HOURS HEATING LOAD	HOURS COINCIDENT COOL-HEAT LOAD	HOURS FLOATING	HOURS HEATING AVAIL.	HOURS COOLING AVAIL.	HOURS FANS ON	HOURS FANS CYCLE ON	HOURS NIGHT VENTING	HOURS FLOATING WHEN FANS ON	HEATING LOAD AT COOLING PEAK (KBTU/HR)	ELECTRIC LOAD AT COOLING PEAK (KW)
JAN	0	717	0	27	744	0	744	0	0	27	-67.651	8.820
FEB	0	602	0	70	672	0	672	0	0	70	-42.928	14.595
MAR	0	566	0	178	744	0	744	0	0	178	-58.499	8.820
APR	0	414	0	306	720	0	720	0	0	306	-2.844	8.820
MAY	384	186	0	174	360	384	744	0	0	174	0.000	14.595
JUN	718	0	0	2	0	718	720	0	0	2	0.000	19.486
JUL	744	0	0	0	0	744	744	0	0	0	0.000	19.486
AUG	744	0	0	0	0	744	744	0	0	0	0.000	19.486
SEP	705	0	0	15	0	705	720	0	0	15	0.000	19.486
OCT	15	442	0	287	720	15	744	0	0	287	0.000	13.711
NOV	0	528	0	192	720	0	720	0	0	192	-69.341	8.820
DEC	0	695	0	49	744	0	744	0	0	49	-75.536	8.820
ANNUAL	3310	4150	0	1300	5424	3310	8760	0	0	1300		

MO	UTILITY-	ELECTRICITY	NATURAL-GAS
	TOTAL(MBTU)	38.580	58.939
JAN	PEAK(KBTU)	69.432	164.720
	DY/HR	28/20	5/ 6
	TOTAL(MBTU)	35.801	39.212
FEB	PEAK(KBTU)	69.432	162.852
	DY/HR	17/14	3/ 8
	TOTAL(MBTU)	37.887	24.283
MAR	PEAK(KBTU)	67.847	136.662
	DY/HR	15/10	3/ 8
	TOTAL(MBTU)	36.300	5.417
APR	PEAK(KBTU)	66.739	92.636
	DY/HR	22/20	5/ 7
	TOTAL(MBTU)	49.591	0.809
MAY	PEAK(KBTU)	151.485	10.586
	DY/HR	16/ 2	5/21
	TOTAL(MBTU)	61.662	0.000
JUN	PEAK(KBTU)	129.216	0.000
	DY/HR	28/17	30/ 1
	TOTAL(MBTU)	67.182	0.000
JUL	PEAK(KBTU)	158.445	0.000
	DY/HR	23/16	31/ 1
	TOTAL(MBTU)	67.088	0.000
AUG	PEAK(KBTU)	153.911	0.000
	DY/HR	11/16	31/ 1
	TOTAL(MBTU)	56.552	0.000
SEP	PEAK(KBTU)	123.854	0.000
	DY/HR	8/18	30/ 1
	TOTAL(MBTU)	37.322	3.007
OCT	PEAK(KBTU)	84.063	71.915
	DY/HR	1/17	2/ 3
	TOTAL(MBTU)	36.719	18.927
NOV	PEAK(KBTU)	68.254	121.224
	DY/HR	12/10	3/ 7
	TOTAL(MBTU)	38.798	50.370
DEC	PEAK(KBTU)	69.432	137.157
	DY/HR	20/10	6/ 7
	ONE YEAR	563.481	200.965
	USE/PEAK	158.445	164.720

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EMC       ENGINEERS       INC.       EZDOE - ELITE SOFTWARE DEVELOPMENT INC        DOE-2.1D   2/17/1995     15:22:48  PDL RUN 1
  DENVER,      CO          80227       EXISTING CONDITION OF BLDG 222           LIQUOR STORE AND TRAINING AREA
REPORT- BEPS  ESTIMATED BUILDING ENERGY PERFORMANCE                                   TOPEKA, KS
```

ENERGY TYPE IN SITE MBTU - CATEGORY OF USE	ELECTRICITY	NATURAL-GAS
SPACE HEAT	7.20	200.97
SPACE COOL	119.51	0.00
HVAC AUX	263.82	0.00
DOM HOT WTR	0.00	0.00
AUX SOLAR	0.00	0.00
LIGHTS	167.47	0.00
VERT TRANS	0.00	0.00
MISC EQUIP	5.49	0.00
TOTAL	563.48	200.97

```
TOTAL SITE ENERGY        764.45 MBTU     144.1 KBTU/SQFT-YR GROSS-AREA      90.9 KBTU/SQFT-YR NET-AREA
TOTAL SOURCE ENERGY     1893.10 MBTU     356.9 KBTU/SQFT-YR GROSS-AREA     225.0 KBTU/SQFT-YR NET-AREA
PERCENT OF HOURS ANY SYSTEM ZONE OUTSIDE OF THROTTLING RANGE =  0.1
PERCENT OF HOURS ANY PLANT LOAD NOT SATISFIED                =  0.0
NOTE  ELECTRICITY AND/OR FUEL USED TO GENERATE ELECTRICITY IS APPORTIONED BASED
      ON THE YEARLY DEMAND.  ALL OTHER ENERGY TYPES ARE APPORTIONED HOURLY.
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EMC ENGINEERS INC. EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/28/1995 11: 9: 1 SDL RUN 1
DENVER, CO 80227 PROPOSED MODIFICATION OF BLDG 222 LIQUOR STORE AND TRAINING AREA
REPORT- SS-A SYSTEM MONTHLY LOADS SUMMARY FOR ~~ZON-1-SZ~~ VAVAHU TOPEKA, KS

MONTH	COOLING ENERGY (MBTU)	TIME OF MAX DY	TIME OF MAX HR	DRY-BULB TEMP	WET-BULB TEMP	MAXIMUM COOLING LOAD (KBTU/HR)	HEATING ENERGY (MBTU)	TIME OF MAX DY	TIME OF MAX HR	DRY-BULB TEMP	WET-BULB TEMP	MAXIMUM HEATING LOAD (KBTU/HR)	ELECTRICAL ENERGY (KWH)	MAXIMUM ELEC LOAD (KW)
	- - - C O O L I N G - - -						- - - H E A T I N G - - -						- - - E L E C - - -	
JAN	0.00000					0.000	-48.131	5	6	2.F	1.F	-125.864	4133.	9.751
FEB	0.00000					0.000	-33.947	3	8	-2.F	-3.F	-126.408	4081.	14.062
MAR	0.00000					0.000	-25.861	3	8	15.F	12.F	-106.032	4477.	18.211
APR	0.00000					0.000	-6.880	5	7	30.F	27.F	-74.130	6269.	18.211
MAY	20.82284	16	2	62.F	59.F	309.228	-2.729	5	6	44.F	40.F	-47.105	5255.	18.211
JUN	41.31012	28	18	89.F	76.F	130.167	0.000					0.000	4455.	11.850
JUL	51.71537	23	17	97.F	79.F	150.472	0.000					0.000	4665.	12.470
AUG	50.77260	24	17	95.F	77.F	139.814	0.000					0.000	4630.	12.678
SEP	29.09936	8	18	89.F	72.F	108.878	0.000					0.000	4314.	11.318
OCT	0.42921	1	17	85.F	68.F	33.696	-5.874	2	2	64.F	59.F	-104.152	6228.	18.211
NOV	0.00000					0.000	-20.271	3	6	13.F	12.F	-93.369	5025.	18.211
DEC	0.00000					0.000	-42.598	6	7	15.F	12.F	-106.758	4210.	9.698
TOTAL	194.149						-186.290						57743.	
MAX						309.228						-126.408		18.211

EMC ENGINEERS INC. EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/28/1995 11: 9: 1 SDL RUN 1
DENVER, CO 80227 PROPOSED MODIFICATION OF BLDG 222 LIQUOR STORE AND TRAINING AREA
REPORT- SS-C SYSTEM MONTHLY LOAD HOURS FOR ~~ZON-1-SZ~~ VAVAHU TOPEKA, KS

MONTH	HOURS COOLING LOAD	HOURS HEATING LOAD	HOURS COINCIDENT COOL-HEAT LOAD	HOURS FLOATING	HOURS HEATING AVAIL.	HOURS COOLING AVAIL.	HOURS FANS ON	HOURS FANS CYCLE ON	HOURS NIGHT VENTING	HOURS FLOATING WHEN FANS ON	HEATING LOAD AT COOLING PEAK (KBTU/HR)	ELECTRIC LOAD AT COOLING PEAK (KW)
	- - - N U M B E R O F H O U R S - - -										--COINCIDENT LOADS--	
JAN	0	744	0	0	744	0	744	0	0	0	-75.630	0.411
FEB	0	665	0	7	672	0	672	0	0	7	-47.006	6.186
MAR	0	674	0	70	744	0	744	0	0	70	-68.211	0.411
APR	0	307	0	413	720	0	720	0	0	413	0.000	2.548
MAY	384	179	0	181	360	384	744	0	0	181	0.000	14.357
JUN	720	0	0	0	0	720	720	0	0	0	0.000	11.850
JUL	744	0	0	0	0	744	744	0	0	0	0.000	12.470
AUG	744	0	0	0	0	744	744	0	0	0	0.000	12.217
SEP	720	0	0	0	0	720	720	0	0	0	0.000	11.318
OCT	24	293	0	427	720	24	744	0	0	427	0.000	3.923
NOV	0	590	0	130	720	0	720	0	0	130	-78.573	0.411
DEC	0	744	0	0	744	0	744	0	0	0	-82.864	0.411
ANNUAL	3336	4196	0	1228	5424	3336	8760	0	0	1228		

EMC ENGINEERS INC. EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/28/1995 11: 9: 1 SDL RUN 1
DENVER, CO 80227 PROPOSED MODIFICATION OF BLDG 222 LIQUOR STORE AND TRAINING AREA
REPORT- SS-A SYSTEM MONTHLY LOADS SUMMARY FOR ZON-2-UTHT TOPEKA, KS

MONTH	COOLING: COOLING ENERGY (MBTU)	COOLING: TIME OF MAX DY	COOLING: TIME OF MAX HR	COOLING: DRY-BULB TEMP	COOLING: WET-BULB TEMP	COOLING: MAXIMUM COOLING LOAD (KBTU/HR)	HEATING: HEATING ENERGY (MBTU)	HEATING: TIME OF MAX DY	HEATING: TIME OF MAX HR	HEATING: DRY-BULB TEMP	HEATING: WET-BULB TEMP	HEATING: MAXIMUM HEATING LOAD (KBTU/HR)	ELEC: ELECTRICAL ENERGY (KWH)	ELEC: MAXIMUM ELEC LOAD (KW)
JAN	0.00000					0.000	-8.147	16	8	14.F	11.F	-35.056	371.	1.424
FEB	0.00000					0.000	-6.067	3	8	-2.F	-3.F	-30.266	354.	1.415
MAR	0.00000					0.000	-4.800	3	9	17.F	13.F	-26.238	388.	1.407
APR	0.00000					0.000	-1.526	5	9	37.F	32.F	-18.540	367.	1.396
MAY	0.00000					0.000	-0.216	5	8	46.F	41.F	-11.000	371.	1.387
JUN	0.00000					0.000	0.000					0.000	367.	1.378
JUL	0.00000					0.000	0.000					0.000	385.	1.378
AUG	0.00000					0.000	0.000					0.000	367.	1.378
SEP	0.00000					0.000	0.000					0.000	376.	1.378
OCT	0.00000					0.000	-1.190	20	9	29.F	29.F	-16.250	371.	1.395
NOV	0.00000					0.000	-3.988	3	9	29.F	24.F	-22.622	361.	1.402
DEC	0.00000					0.000	-7.269	14	9	10.F	8.F	-32.730	400.	1.419
TOTAL	0.000						-33.204						4476.	
MAX						0.000						-35.056		1.424

D1-13

EMC ENGINEERS INC. EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/28/1995 11: 9: 1 SDL RUN 1
DENVER, CO 80227 PROPOSED MODIFICATION OF BLDG 222 LIQUOR STORE AND TRAINING AREA
REPORT- SS-C SYSTEM MONTHLY LOAD HOURS FOR ZON-2-UTHT TOPEKA, KS

MONTH	HOURS COOLING LOAD	HOURS HEATING LOAD	HOURS COINCIDENT COOL-HEAT LOAD	HOURS FLOATING	HOURS HEATING AVAIL.	HOURS COOLING AVAIL.	HOURS FANS ON	HOURS FANS CYCLE ON	HOURS NIGHT VENTING	HOURS FLOATING WHEN FANS ON	COINCIDENT LOADS: HEATING LOAD AT COOLING PEAK (KBTU/HR)	COINCIDENT LOADS: ELECTRIC LOAD AT COOLING PEAK (KW)
JAN	0	372	0	372	744	0	372	372	0	0	-21.383	0.028
FEB	0	335	0	337	672.	0	335	335	0	0	0.000	0.000
MAR	0	339	0	405	744	0	339	339	0	0	0.000	0.000
APR	0	157	0	563	720	0	222	222	0	65	0.000	0.000
MAY	0	30	0	714	360	0	561	561	0	531	0.000	0.000
JUN	0	0	0	720	0	0	720	720	0	720	0.000	0.000
JUL	0	0	0	744	0	0	744	744	0	744	0.000	0.000
AUG	0	0	0	744	0	0	744	744	0	744	0.000	0.000
SEP	0	0	0	720	0	0	692	692	0	692	0.000	0.000
OCT	0	137	0	607	720	0	277	277	0	140	0.000	0.000
NOV	0	315	0	405	720	0	315	315	0	0	0.000	0.000
DEC	0	372	0	372	744	0	372	372	0	0	0.000	0.000
ANNUAL	0	2057	0	6703	5424	0	5693	5693	0	3636		

MO	UTILITY-	ELECTRICITY	NATURAL-GAS
	TOTAL(MBTU)	17.909	80.229
JAN	PEAK(KBTU)	41.492	199.821
	DY/HR	15/10	5/ 6
	TOTAL(MBTU)	17.312	59.418
FEB	PEAK(KBTU)	52.719	198.143
	DY/HR	26/17	3/ 8
	TOTAL(MBTU)	18.442	46.781
MAR	PEAK(KBTU)	66.887	168.657
	DY/HR	27/17	3/ 7
	TOTAL(MBTU)	23.295	13.851
APR	PEAK(KBTU)	66.887	128.341
	DY/HR	16/19	5/ 7
	TOTAL(MBTU)	27.921	5.244
MAY	PEAK(KBTU)	125.391	88.430
	DY/HR	16/ 2	5/ 6
	TOTAL(MBTU)	33.262	0.000
JUN	PEAK(KBTU)	89.905	0.000
	DY/HR	28/17	30/ 1
	TOTAL(MBTU)	37.433	0.000
JUL	PEAK(KBTU)	115.105	0.000
	DY/HR	23/16	31/ 1
	TOTAL(MBTU)	37.423	0.000
AUG	PEAK(KBTU)	99.562	0.000
	DY/HR	11/16	31/ 1
	TOTAL(MBTU)	29.028	0.000
SEP	PEAK(KBTU)	83.375	0.000
	DY/HR	8/18	30/ 1
	TOTAL(MBTU)	23.344	11.932
OCT	PEAK(KBTU)	66.887	150.185
	DY/HR	27/20	2/ 2
	TOTAL(MBTU)	19.962	37.866
NOV	PEAK(KBTU)	66.887	153.982
	DY/HR	23/20	3/ 7
	TOTAL(MBTU)	18.213	72.634
DEC	PEAK(KBTU)	41.476	174.148
	DY/HR	14/11	6/ 7
	ONE YEAR	303.543	327.956
	USE/PEAK	125.391	199.821

REPORT- BEPS ESTIMATED BUILDING ENERGY PERFORMANCE

ENERGY TYPE IN SITE MBTU - CATEGORY OF USE	ELECTRICITY	NATURAL-GAS
SPACE HEAT	12.07	327.96
SPACE COOL	79.04	0.00
HVAC AUX	39.48	0.00
DOM HOT WTR	0.00	0.00
AUX SOLAR	0.00	0.00
LIGHTS	167.47	0.00
VERT TRANS	0.00	0.00
MISC EQUIP	5.49	0.00
TOTAL	303.54	327.96

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TOTAL SITE ENERGY        631.50 MBTU    119.1 KBTU/SQFT-YR GROSS-AREA     75.1 KBTU/SQFT-YR NET-AREA
TOTAL SOURCE ENERGY     1239.50 MBTU    233.7 KBTU/SQFT-YR GROSS-AREA    147.3 KBTU/SQFT-YR NET-AREA
PERCENT OF HOURS ANY SYSTEM ZONE OUTSIDE OF THROTTLING RANGE = 51.8
PERCENT OF HOURS ANY PLANT LOAD NOT SATISFIED                =  0.0
NOTE  ELECTRICITY AND/OR FUEL USED TO GENERATE ELECTRICITY IS APPORTIONED BASED
      ON THE YEARLY DEMAND.  ALL OTHER ENERGY TYPES ARE APPORTIONED HOURLY.
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BUILDING 5000
ANNUAL ENERGY SAVINGS SUMMARY

Item	Baseline	ECO	Annual Energy Savings	Adj. Annual Energy Savings*
Annual Electric (MBTU)	408.42	326.52	81.90	81.90
Annual Natural Gas (MBTU)	275.56	79.38	196.18	196.18
Electric Demand June (KW)	31.33	30.30	1.03	1.03
Electric Demand July (KW)	31.90	31.79	0.11	0.11
Electric Demand August (KW)	31.75	33.01	-1.26	-1.26

*Energy savings prorated on a square foot basis:

Baseline Model Bldg 5000 (sq.ft.)	4667
ECO Model Bldg 5000 (sq.ft.)	4667
Square Footage Adjustment Factor	1.000

LIFE CYCLE COST ANALYSIS SUMMARY
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

LOCATION:	Fort Riley	REGION: 2 (Kansas)		PROJECT NO:	1406-005
PROJECT TITLE:	Feasibility Study for HVAC Upgrade			FISCAL YEAR:	1995
ANALYSIS DATE:	05/08/95	ECONOMIC LIFE:	20	PREPARED BY:	C. Wohlert

1. INVESTMENT: **BLDG 5000 - Replace MZ AHU w/ 3 Furnace Air Conditioning Units**

A.	CONSTRUCTION COST	=	$37,026	
B.	SIOH COST	(5.5% of 1A) =	$2,036	
C.	DESIGN COST	(6.0% of 1A) =	$2,222	
D.	TOTAL COST	(1A +1B +1C) =	$41,284	
E.	SALVAGE VALUE OF EXISTING EQUIPMENT =		$0	
F.	PUBLIC UTILITY COMPANY REBATE =		$0	
G.	TOTAL INVESTMENT	(1D -1E -1F) =	------->	$41,284

2. ENERGY SAVINGS (+) OR COST (-):
DATE OF NISTR 85-3273-9 USED FOR DISCOUNT FACTORS: JAN '95

	ENERGY SOURCE	FUEL COST $/MBTU (1)	SAVINGS MBTU/YR (2)	ANNUAL $ SAVINGS (3)	DISCOUNT FACTOR (4)	DISCOUNTED SAVINGS (5)	
A.	ELECT.	$12.10	82	$991	15.88	$15,737	
B.	DIST	$0.00	0	$0	19.16	$0	
C.	NAT GAS	$4.12	196	$808	18.30	$14,793	
D.	COAL	$0.00	0	$0	16.62	$0	
E.	ELEC. DEMAND			($47)	14.88	($701)	
F.	TOTAL		278	$1,752		-------->	$29,829

3. NON-ENERGY SAVINGS (+) OR COST (-)
A. ANNUAL RECURRING (+/-)

1	ANNUAL MAINTENANCE	$652	14.88	$9,696
2		$0	14.88	$0
3		$0	14.88	$0
4	TOTAL ANNUAL DISC. SAVINGS (+) / COST	$652		$9,696

B. NON-RECURRING (+/-)

ITEM	SAVINGS (+) COST(-) (1)	YEAR OF OCCURRENCE (2)	DISCOUNT FACTOR (3) (TABLE A-2)	DISCOUNTED SAVINGS/COST (4)
a. BASELINE EQUIP. REPLCMNT.	$72,986	5	0.863	$62,987
b.				$0
c.				$0
d.				$0
e.				$0
f. TOTAL	$72,986			$62,987

C. TOTAL NON-ENERGY DISCOUNTED SAVINGS (+) OR COST (-) (3A4 + 3Bf4) = $72,683

4. FIRST YEAR DOLLAR SAVINGS (+) / COSTS (-)	(2F3+3A4+(3Bf1/Economic Life))	$6,053
5. SIMPLE PAYBACK (SPB) IN YEARS (MUST BE < 10 YEARS TO QUALIFY)	(1G/4) =	6.82
6. TOTAL NET DISCOUNTED SAVINGS	(2F5 + 3C) =	$102,511
7. DISCOUNTED SAVINGS-TO-INVESTMENT RATIO (SIR) (MUST HAVE SIR > 1.25 TO QUALIFY)	(6/1G) =	2.48

ENGINEER'S OPINION OF PROBABLE COST

PROJECT	Fort Riley Feasibility Study for HVAC Upgrade	SHEET 1 OF 1	
ENGINEER	E M C Engineers, Inc. Denver, CO	DATE PREPARED	8-May-95
		ESTIMATOR	C. Wohlert
		CHECKED BY	A. Niemeyer

Line No.	Item Refer Code	Item Description	Unit of Measure	MATERIAL COST Quantity	MATERIAL COST Unit Cost	MATERIAL COST Total	LABOR COST Crew/ Worker	LABOR COST Hours/ Unit	LABOR COST Total	TOTAL
1		**BUILDING 5000**								
2		**PROPOSED SYSTEM MODIFICATIONS**								
3										
4		*NEW SYSTEMS INSTALLATION*								
5	FAC1	FURNACE AIR CONDITIONER, 4 TON	EA.	1.0	$1,782.96	$1,783	Q-9	20	$375	$2,158
6	FAC2	FURNACE AIR CONDITIONER, 5 - 6 TON	EA.	2.0	$2,596.92	$5,194	Q-10	24	$933	$6,126
7	ACCU4	4 TON ACCU	EA.	1.0	$1,405.05	$1,405	Q-5	17.778	$345	$1,750
8	ACCU5	5 TON ACCU	EA.	1.0	$1,719.98	$1,720	Q-5	26.667	$517	$2,237
9	ACCU7.5	7.5 TON ACCU	EA.	1.0	$3,125.03	$3,125	Q-5	29.091	$564	$3,689
10	MCUPIP1	COPPER TUBE, TYPE L, 3/4" OD	L.F.	225.0	$1.41	$316	1-PLUM	0.103	$499	$815
11	DUCT100	GAL. STEEL DUCTWORK, 500 TO 1000 LB.	LB.	600.0	$0.47	$279	Q-10	0.094	$1,096	$1,375
12	10"FLEX	10 IN. DIA. FLEX DUCT	L.F.	10.0	$2.55	$25	Q-9	0.114	$21	$47
13	MODBLR1	MODULAR HW BOILER, 320 MBH	EA.	1.0	$2,640.53	$2,641	Q-7	40	$822	$3,463
14	HWP1	1/3 HP, CI FLANGE, IN-LINE, 3/4"-1-1/2" SIZE	EA.	1.0	$300.39	$300	Q-1	2.667	$52	$352
15										
16										
17										
18										
19			0							
20										
21		*EXISTING SYSTEMS DEMOLITION*								
22		BOILER DEMOLITION	EA.	1.0			Q-6	12	$241	$241
23		MZ AHU DEMOLITION	TON	1.0			Q-5	14.545	$282	$282
24		HOT WATER PIPING DEMOLITION	L.F.	50.0			1-PLUM	0.04	$43	$43
25		DUCTWORK DEMOLITION	L.F.	50.0			1-CLAB	0.107	$77	$77
26		ASBESTOS REMOVAL	GLV. BAG	8.0	$170.00	$1,360				$1,360
27										
28										
29										
30										
31		**SUBTOTAL**				$18,148			$5,867	$24,016
32	OH	OVERHEAD			17%	$3,049			$986	$4,035
33	PRO	PROFIT			10%	$2,120			$685	$2,805
34	CONT	CONTINGENCY			20%	$4,663			$1,508	$6,171
35	**TOTAL COST**		-	-	-	$27,981	-	-	$9,046	$37,026

ENGINEER'S OPINION OF PROBABLE COST

PROJECT	Fort Riley Feasibility Study for HVAC Upgrade	SHEET 1	OF 1
ENGINEER	E M C Engineers, Inc.	DATE PREPARED	4-May-95
	Denver, CO	ESTIMATOR	C. Wohlert
		CHECKED BY	A. Niemeyer

Line No.	Item Refer Code	Item Description	Unit of Measure	MATERIAL COST Quantity	MATERIAL COST Unit Cost	MATERIAL COST Total	LABOR COST Crew/ Worker	LABOR COST Hours/ Unit	LABOR COST Total	TOTAL
1		**BUILDING 5000**								
2		**NON-RECURRING**								
3										
4		*BASELINE - EXISTING EQUIP. REPLACEMENT*								
5	HWBLR1	765 MBH HOT WATER BOILER (Cast Iron)	EA.	1.0	$5,354	$5,354	Q-7	58.182	$1,196	$6,550
6	MZ15TON	15 TON MULTIZONE AHU	EA.	1.0	$31,115	$31,115	Q-7	145	$2,980	$34,095
7	ACCU15	15 TON ACCU	EA.	1.0	$5,184	$5,184	Q-5	40	$776	$5,960
8										
9										
10										
11										
12										
13		*EXISTING SYSTEMS DEMOLITION*								
14		BOILER DEMOLITION	EA.	1.0			Q-6	12	$241	$241
15		MZ AHU DEMOLITION	TON	1.0			Q-5	14.545	$282	$282
16		ACCU DEMOLITION	TON	0.8			Q-5	14.545	$212	$212
17										
18										
19			0							
20										
21										
22										
23										
24										
25										
26										
27										
28										
29										
30										
31		**SUBTOTAL**				$41,652			$5,687	$47,339
32	OH	OVERHEAD			17%	$6,998			$955	$7,953
33	PRO	PROFIT			10%	$4,865			$664	$5,529
34	CONT	CONTINGENCY			20%	$10,703			$1,461	$12,164
35	**TOTAL COST**		-	-	-	$64,218	-	-	$8,768	$72,986

ENGINEER'S OPINION OF PROBABLE COST

PROJECT	Fort Riley Feasibility Study for HVAC Upgrade	**SHEET** 1 **OF** 1	
ENGINEER	E M C Engineers, Inc.	**DATE PREPARED**	4-May-95
	Denver, CO	**ESTIMATOR**	C. Wohlert
		CHECKED BY	A. Niemeyer

Line No.	Item Refer Code	Item Description	Unit of Measure	MATERIAL COST Quantity	MATERIAL COST Unit Cost	MATERIAL COST Total	LABOR COST Crew/ Worker	LABOR COST Hours/ Unit	LABOR COST Total	TOTAL
1		**BUILDING 5000**								
2		***ANNUAL RECURRING***								
3		***ANNUAL MAINTENANCE COST - BASELINE***								
4	MNT-BLR	MAINT. ON BOILERS - <2.5 MBH	EA.	1.0	$48.45	$48	Q-6	17	$342	$390
5	MNT-AHU	MAINT. ON AHU - INSPEC. / YR > 5000 CFM	EA.	1.0			Q-6	25	$503	$503
6										
7										
8										
9										
10										
11										
12										
13										
14										
15	**TOTAL ANNUAL MAINTENANCE COST - BASELINE**		-	-	-	$48	-	-	$844	$893
16										
17		***ANNUAL MAINTENANCE COST - NEW HVAC REPLACEMENT***								
18	MNT-FAC	MAINT. ON FAC - INSPEC. / YR	EA.	3.0			Q-6	4	$241	$241
19			0							
20										
21										
22										
23										
24										
25										
26										
27										
28										
29	**TOTAL ANNUAL MAINTENANCE COST - BASELINE**		-	-	-	$0	-	-	$241	$241
30										
31										
32										
33										
34										
35	**TOTAL ANNUAL MAINTENANCE COST SAVINGS**		-	-	-	$48	-	-	$603	$652

DEMAND LIMITING ANALYSIS BUILDING 5000

SUMMER PEAK (KW) = 27812	1993 JUL BILL 7/1-8/2 ACTUAL	1993 AUG BILL 8/2-9/1 ACTUAL	1993 SEP BILL 9/3-10/1 ACTUAL	1993 OCT BILL 10/1-11/1 ACTUAL	1993 NOV BILL 11/1-12/1 ACTUAL	1993 DEC BILL 12/1-1/3 ACTUAL	1993 JAN BILL 1/4-2/1 ACTUAL	1993 FEB BILL 2/1-3/1 ACTUAL	1993 MAR BILL 3/3-4/1 ACTUAL	1993 APR BILL 4/1-5/3 ACTUAL	1993 MAY BILL 5/3-6/1 ACTUAL	1993 JUN BILL 6/1-7/1 ACTUAL
BASE CASE												
CAPACITY (KW)	32472	34452	26136	20754	26400	22752	27108	25812	23310	21834	21996	30096
POWER FACTOR (%)	99.20%	99.10%	99.10%	99.90%	99.80%	99.70%	99.50%	99.60%	99.60%	99.80%	99.60%	98.80%
CAPACITY (KVA)	32734	34765	26373	20775	26453	22820	27244	25916	23404	21878	22084	30462
80% SUMMER PEAK (KVA)	27812	27812	27812	27812	27812	27812	27812	27812	27812	27812	27812	27812
CONTRACT MINIMUM (KVA)	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643
BILLING CAPACITY (KVA)	32734	34765	27812	27812	27812	27812	27812	27812	27812	27812	27812	30462
ACTUAL OR 80% PEAK	ACTUAL	ACTUAL	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	ACTUAL
200 KVA @ $4.45	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00
NEXT 400 @ $4.25	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00
REMAINING @ $4.05	$130,142.18	$138,367.78	$110,208.22	$110,208.22	$110,208.22	$110,208.22	$110,208.22	$110,208.22	$110,208.22	$110,208.22	$110,208.22	$120,939.23
SUB DISCOUNT $.20	($6,546.77)	($6,952.98)	($5,562.38)	($5,562.38)	($5,562.38)	($5,562.38)	($5,562.38)	($5,562.38)	($5,562.38)	($5,562.38)	($5,562.38)	($6,092.31)
CAPACITY CHARGE	$126,185.40	$134,004.80	$107,235.84	$107,235.84	$107,235.84	$107,235.84	$107,235.84	$107,235.84	$107,235.84	$107,235.84	$107,235.84	$117,436.92
TOTAL ENERGY (KWH)	16,920,000	16,200,000	10,980,000	10,140,000	11,160,000	12,930,000	12,600,000	12,270,000	12,480,000	11,070,000	9,720,000	13,170,000
50*KVA @ $.03924	$64,223.85	$68,208.70	$54,566.96	$54,566.96	$54,566.96	$54,566.96	$54,566.96	$54,566.96	$54,566.96	$54,566.96	$54,566.96	$59,765.54
100*KVA @ $.03404	$111,426.10	$118,339.66	$94,671.73	$94,671.73	$94,671.73	$94,671.73	$94,671.73	$94,671.73	$94,671.73	$94,671.73	$94,671.73	$103,691.08
250*KVA @ $.03084	$252,378.15	$268,037.26	$209,965.32	$184,059.72	$214,429.80	$214,429.80	$214,429.80	$214,429.80	$214,429.80	$212,740.92	$171,106.92	$234,858.46
EXCESS @ $.02864	$109,589.57	$65,701.49	$0.00	$0.00	$1,009.19	$51,701.99	$42,250.79	$32,799.59	$38,813.99	$0.00	$0.00	$28,221.42
ENERGY CHARGE	$537,617.67	$520,287.11	$359,204.01	$333,298.41	$364,677.69	$415,370.49	$405,919.29	$396,468.09	$402,482.49	$361,979.61	$320,345.61	$426,536.49
TOTAL CHARGE LESS ECA	$663,803.07	$654,291.92	$466,439.85	$440,534.25	$471,913.53	$522,606.33	$513,155.13	$503,703.93	$509,718.33	$469,215.45	$427,581.45	$543,973.42
DEMAND REDUCTION (KW)	**0.11**	**(1.26)**	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**1.03**
CAPACITY (KW)	32472	34453	26136	20754	26400	22752	27108	25812	23310	21834	21996	30095
POWER FACTOR (%)	99.20%	99.10%	99.10%	99.90%	99.80%	99.70%	99.50%	99.60%	99.60%	99.80%	99.60%	98.80%
CAPACITY (KVA)	32734	34766	26373	20775	26453	22820	27244	25916	23404	21878	22084	30460
80% SUMMER PEAK (KVA)	27813	27813	27813	27813	27813	27813	27813	27813	27813	27813	27813	27813
CONTRACT MINIMUM (KVA)	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643
BILLING CAPACITY (KVA)	32734	34766	27813	27813	27813	27813	27813	27813	27813	27813	27813	30460
ACTUAL OR 80% PEAK	ACTUAL	ACTUAL	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	ACTUAL
200 KVA @ $4.45	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00
NEXT 400 @ $4.25	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00
REMAINING @ $4.05	$130,141.74	$138,372.93	$110,212.34	$110,212.34	$110,212.34	$110,212.34	$110,212.34	$110,212.34	$110,212.34	$110,212.34	$110,212.34	$120,934.99
SUB DISCOUNT $.20	($6,546.75)	($6,953.23)	($5,562.58)	($5,562.58)	($5,562.58)	($5,562.58)	($5,562.58)	($5,562.58)	($5,562.58)	($5,562.58)	($5,562.58)	($6,092.10)
CAPACITY CHARGE	$126,184.99	$134,009.70	$107,239.76	$107,239.76	$107,239.76	$107,239.76	$107,239.76	$107,239.76	$107,239.76	$107,239.76	$107,239.76	$117,432.89
TOTAL ENERGY (KWH)	16,920,000	16,200,000	10,980,000	10,140,000	11,160,000	12,930,000	12,600,000	12,270,000	12,480,000	11,070,000	9,720,000	13,170,000
50*KVA @ $.03924	$64,223.64	$68,211.20	$54,568.96	$54,568.96	$54,568.96	$54,568.96	$54,568.96	$54,568.96	$54,568.96	$54,568.96	$54,568.96	$59,763.48
100*KVA @ $.03404	$111,425.73	$118,343.99	$94,675.19	$94,675.19	$94,675.19	$94,675.19	$94,675.19	$94,675.19	$94,675.19	$94,675.19	$94,675.19	$103,687.51
250*KVA @ $.03084	$252,377.31	$268,047.05	$209,960.61	$184,055.01	$214,437.64	$214,437.64	$214,437.64	$214,437.64	$214,437.64	$212,736.21	$171,102.21	$234,850.39
EXCESS @ $.02864	$109,590.81	$65,686.93	$0.00	$0.00	$997.54	$51,690.34	$42,239.14	$32,787.94	$38,802.34	$0.00	$0.00	$28,233.41
ENERGY CHARGE	$537,617.50	$520,289.17	$359,204.76	$333,299.16	$364,679.34	$415,372.14	$405,920.94	$396,469.74	$402,484.14	$361,980.36	$320,346.36	$426,534.80
TOTAL CHARGE LESS ECA	$663,802.48	$654,298.87	$466,444.52	$440,538.92	$471,919.09	$522,611.89	$513,160.69	$503,709.49	$509,723.89	$469,220.12	$427,586.12	$543,967.69
SUMMARY												
MONTHLY DIFFERENCE	$0.59	($6.95)	($4.67)	($4.67)	($5.56)	($5.56)	($5.56)	($5.56)	($5.56)	($4.67)	($4.67)	$5.73
ANNUAL DIFFERENCE..............		**($47.11)**										

EMC ENGINEERS INC. EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/ 7/1995 11:41:11 LDL RUN 1
DENVER, CO 80227 EXISTING CONDITION OF BLDG. #5000 FIRE STATION
REPORT- LV-D DETAILS OF EXTERIOR SURFACES IN THE PROJECT TOPEKA, KS

NUMBER OF EXTERIOR SURFACES 11 RECTANGULAR 11 OTHER 0
(U-VALUE INCLUDES INSIDE AIR FILM PLUS OUTSIDE AIR FILM AT 7.5 MPH WINDSPEED)

SURFACE	SPACE	GLASS U-VALUE (BTU/HR-SQFT-F)	GLASS AREA (SQFT)	WALL U-VALUE (BTU/HR-SQFT-F)	WALL AREA (SQFT)	WALL+GLASS U-VALUE (BTU/HR-SQFT-F)	WALL+GLASS AREA (SQFT)	AZIMUTH
	N_PERI_ZON	0.490	192.00	0.068	294.00	0.234	486.00	NORTH
	N_PERI_ZON	0.000	0.00	0.064	243.00	0.064	243.00	NORTH
	S_PERI-ZON	0.490	140.00	0.068	517.00	0.158	657.00	SOUTH
	S_PERI-ZON	0.000	0.00	0.064	328.50	0.064	328.50	SOUTH
	S_PERI-ZON	0.000	0.00	0.068	292.50	0.068	292.50	WEST
	S_PERI-ZON	0.000	0.00	0.064	97.50	0.064	97.50	WEST
	N_PERI_ZON	0.000	0.00	0.068	328.50	0.068	328.50	WEST
	N_PERI_ZON	0.000	0.00	0.064	109.50	0.064	109.50	WEST
	S_PERI-ZON	0.000	0.00	0.036	1776.00	0.036	1776.00	ROOF
	N_PERI_ZON	0.000	0.00	0.036	1333.00	0.036	1333.00	ROOF
	CORE_ZONE	0.000	0.00	0.036	1801.25	0.036	1801.25	ROOF
	S_PERI-ZON	0.000	0.00	0.020	1776.00	0.020	1776.00	UNDERGRND
	N_PERI_ZON	0.000	0.00	0.020	1333.00	0.020	1333.00	UNDERGRND
	CORE_ZONE	0.000	0.00	0.020	1553.75	0.020	1553.75	UNDERGRND

EMC ENGINEERS INC. EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/ 7/1995 11:41:11 LDL RUN 1
DENVER, CO 80227 EXISTING CONDITION OF BLDG. #5000 FIRE STATION
REPORT- LV-D DETAILS OF EXTERIOR SURFACES IN THE PROJECT TOPEKA, KS

	AVERAGE U-VALUE/GLASS (BTU/HR-SQFT-F)	AVERAGE U-VALUE/WALLS (BTU/HR-SQFT-F)	AVERAGE U-VALUE WALLS+GLASS (BTU/HR-SQFT-F)	GLASS AREA (SQFT)	OPAQUE AREA (SQFT)	GLASS+OPAQUE AREA (SQFT)
NORTH	0.490	0.066	0.178	192.00	537.00	729.00
SOUTH	0.490	0.066	0.126	140.00	845.50	985.50
WEST	0.000	0.067	0.067	0.00	828.00	828.00
ROOF	0.000	0.036	0.036	0.00	4910.25	4910.25
ALL WALLS	0.490	0.066	0.122	332.00	2210.50	2542.50
WALLS+ROOFS	0.490	0.045	0.065	332.00	7120.75	7452.75
UNDERGRND	0.000	0.020	0.020	0.00	4662.75	4662.75
BUILDING	0.490	0.035	0.048	332.00	11783.50	12115.50

EMC ENGINEERS INC. EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/ 7/1995 11:41:11 LDL RUN 1
DENVER, CO 80227 EXISTING CONDITION OF BLDG. #5000 FIRE STATION
REPORT- LS-C BUILDING PEAK LOAD COMPONENTS TOPEKA, KS

*** BUILDING ***

FLOOR AREA	4667	SQFT	434	SQMT
VOLUME	62998	CUFT	1784	CUMT

	COOLING LOAD		HEATING LOAD	
TIME	AUG 4	6PM	JAN 15	5AM
DRY-BULB TEMP	92F	33C	-8F	-22C
WET-BULB TEMP	70F	21C	-9F	-23C

	COOLING SENSIBLE (KBTU/H)	COOLING SENSIBLE (KW)	COOLING LATENT (KBTU/H)	COOLING LATENT (KW)	HEATING SENSIBLE (KBTU/H)	HEATING SENSIBLE (KW)
WALLS	5.442	1.594	0.000	0.000	-11.726	-3.434
ROOFS	11.284	3.305	0.000	0.000	-9.323	-2.731
GLASS CONDUCTION	1.979	0.580	0.000	0.000	-13.072	-3.829
GLASS SOLAR	10.219	2.993	0.000	0.000	0.870	0.255
DOOR	0.052	0.015	0.000	0.000	-0.134	-0.039
INTERNAL SURFACES	0.000	0.000	0.000	0.000	0.000	0.000
UNDERGROUND SURFACES	-0.441	-0.129	0.000	0.000	-1.785	-0.523
OCCUPANTS TO SPACE	5.627	1.648	9.378	2.747	3.753	1.099
LIGHT TO SPACE	24.308	7.119	0.000	0.000	3.469	1.016
EQUIPMENT TO SPACE	21.276	6.231	0.000	0.000	1.085	0.318
PROCESS TO SPACE	0.000	0.000	0.000	0.000	0.000	0.000
INFILTRATION	0.000	0.000	0.000	0.000	0.000	0.000
TOTAL	79.746	23.356	9.378	2.747	-26.864	-7.868
TOTAL LOAD	89.124 KBTU/H		26.102 KW		-26.864 KBTU/H	-7.868 KW
TOTAL LOAD / AREA	19.10BTU/H.SQFT		60.207 W /SQMT		5.757BTU/H.SQFT	18.148 W /SQMT

NOTE 1)THE ABOVE LOADS EXCLUDE OUTSIDE VENTILATION AIR LOADS
2)TIMES GIVEN IN STANDARD TIME FOR THE LOCATION IN CONSIDERATION

EMC ENGINEERS INC. EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/ 7/1995 11:41:11 SDL RUN 1
DENVER, CO 80227 EXISTING CONDITION OF BLDG. #5000 FIRE STATION
REPORT- SS-A SYSTEM MONTHLY LOADS SUMMARY FOR MZ_SYSTEM TOPEKA, KS

	COOLING						HEATING						ELEC	
MONTH	COOLING ENERGY (MBTU)	TIME OF MAX DY	HR	DRY-BULB TEMP	WET-BULB TEMP	MAXIMUM COOLING LOAD (KBTU/HR)	HEATING ENERGY (MBTU)	TIME OF MAX DY	HR	DRY-BULB TEMP	WET-BULB TEMP	MAXIMUM HEATING LOAD (KBTU/HR)	ELEC-TRICAL ENERGY (KWH)	MAXIMUM ELEC LOAD (KW)
JAN	0.00000					0.000	-49.094	15	5	-8.F	-9.F	-171.380	8003.	19.956
FEB	0.00000					0.000	-34.759	3	5	-1.F	-2.F	-150.421	7193.	18.956
MAR	0.00000					0.000	-24.629	4	5	14.F	12.F	-115.125	7957.	18.956
APR	0.00000					0.000	-5.136	5	5	31.F	29.F	-70.895	7701.	18.956
MAY	19.02822	31	16	88.F	75.F	130.626	-0.659	5	5	44.F	40.F	-26.835	9709.	31.032
JUN	51.40051	24	12	84.F	76.F	131.101	0.000					0.000	12457.	31.318
JUL	69.27947	1	16	86.F	80.F	141.854	0.000					0.000	14363.	31.889
AUG	65.85220	20	13	92.F	78.F	131.421	0.000					0.000	14261.	31.736
SEP	34.29221	22	18	85.F	75.F	132.800	0.000					0.000	10882.	31.165
OCT	0.81302	1	18	83.F	68.F	109.631	-3.490	20	5	25.F	25.F	-81.055	8035.	29.008
NOV	0.00000					0.000	-18.773	3	5	13.F	12.F	-114.579	7701.	18.956
DEC	0.00000					0.000	-42.321	12	5	4.F	3.F	-138.342	7958.	18.956
TOTAL	240.665						-178.861						116219.	
MAX						141.854						-171.380		31.889

D1-25

EMC ENGINEERS INC. EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/ 7/1995 11:41:11 SDL RUN 1
DENVER, CO 80227 EXISTING CONDITION OF BLDG. #5000 FIRE STATION
REPORT- SS-C SYSTEM MONTHLY LOAD HOURS FOR MZ_SYSTEM TOPEKA, KS

	NUMBER OF HOURS										COINCIDENT LOADS	
MONTH	HOURS COOLING LOAD	HOURS HEATING LOAD	HOURS COINCIDENT COOL-HEAT LOAD	HOURS FLOATING	HOURS HEATING AVAIL.	HOURS COOLING AVAIL.	HOURS FANS ON	HOURS FANS CYCLE ON	HOURS NIGHT VENTING	HOURS FLOATING WHEN FANS ON	HEATING LOAD AT COOLING PEAK (KBTU/HR)	ELECTRIC LOAD AT COOLING PEAK (KW)
JAN	0	744	0	0	744	0	744	0	0	0	-60.222	3.847
FEB	0	672	0	0	672	0	672	0	0	0	-58.174	3.847
MAR	0	744	0	0	744	0	744	0	0	0	-61.906	3.847
APR	0	720	0	0	720	0	720	0	0	0	-1.775	3.847
MAY	244	360	0	140	360	384	744	0	0	140	0.000	24.295
JUN	564	0	0	156	0	720	720	0	0	156	0.000	31.086
JUL	707	0	0	37	0	744	744	0	0	37	0.000	24.691
AUG	686	0	0	58	0	744	744	0	0	58	0.000	27.751
SEP	410	0	0	310	0	720	720	0	0	310	0.000	30.654
OCT	11	720	0	13	720	24	744	0	0	13	0.000	29.008
NOV	0	720	0	0	720	0	720	0	0	0	-77.140	3.847
DEC	0	744	0	0	744	0	744	0	0	0	-76.802	3.847
ANNUAL	2622	5424	0	714	5424	3336	8760	0	0	714		

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EMC       ENGINEERS      INC.       EZDOE - ELITE SOFTWARE DEVELOPMENT INC       DOE-2.1D  2/ 7/1995    11:41:11  PDL RUN 1
 DENVER,        CO       80227       EXISTING CONDITION OF BLDG. #5000      FIRE STATION
REPORT- PS-B  MONTHLY PEAK AND TOTAL ENERGY USE                                  TOPEKA, KS
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MO	UTILITY-	ELECTRICITY	NATURAL-GAS
	TOTAL(MBTU)	29.860	71.294
JAN	PEAK(KBTU)	72.103	216.188
	DY/HR	15/12	15/ 5
	TOTAL(MBTU)	26.727	52.768
FEB	PEAK(KBTU)	68.688	193.981
	DY/HR	17/12	3/ 5
	TOTAL(MBTU)	28.923	38.822
MAR	PEAK(KBTU)	68.688	155.443
	DY/HR	29/12	4/ 5
	TOTAL(MBTU)	26.914	10.010
APR	PEAK(KBTU)	65.910	105.133
	DY/HR	4/12	5/ 5
	TOTAL(MBTU)	33.317	2.002
MAY	PEAK(KBTU)	105.957	46.419
	DY/HR	31/18	5/ 5
	TOTAL(MBTU)	42.535	0.000
JUN	PEAK(KBTU)	106.933	0.000
	DY/HR	28/12	30/ 1
	TOTAL(MBTU)	49.043	0.000
JUL	PEAK(KBTU)	108.881	0.000
	DY/HR	23/12	31/ 1
	TOTAL(MBTU)	48.695	0.000
AUG	PEAK(KBTU)	108.360	0.000
	DY/HR	21/12	31/ 1
	TOTAL(MBTU)	37.154	0.000
SEP	PEAK(KBTU)	106.409	0.000
	DY/HR	7/12	30/ 1
	TOTAL(MBTU)	27.931	7.424
OCT	PEAK(KBTU)	99.046	116.889
	DY/HR	1/18	20/ 5
	TOTAL(MBTU)	27.708	30.173
NOV	PEAK(KBTU)	67.920	154.836
	DY/HR	30/12	3/ 5
	TOTAL(MBTU)	29.608	63.063
DEC	PEAK(KBTU)	68.688	180.953
	DY/HR	31/12	12/ 5
	ONE YEAR	408.414	275.557
	USE/PEAK	108.881	216.188

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    EMC      ENGINEERS      INC.      EZDOE - ELITE SOFTWARE DEVELOPMENT INC      DOE-2.1D   2/ 7/1995    11:41:11  PDL RUN 1
    DENVER,      CO        80227      EXISTING CONDITION OF BLDG. #5000      FIRE STATION
REPORT- BEPS  ESTIMATED BUILDING ENERGY PERFORMANCE                                 TOPEKA, KS
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                               ENERGY TYPE
                               IN SITE MBTU -  ELECTRICITY     NATURAL-GAS
                              CATEGORY OF USE
                                 SPACE HEAT        10.72          275.56
                                 SPACE COOL        76.93            0.00
                                 HVAC AUX          86.62            0.00
                                 DOM HOT WTR        0.00            0.00
                                 AUX SOLAR          0.00            0.00
                                 LIGHTS           152.87            0.00
                                 VERT TRANS         0.00            0.00
                                 MISC EQUIP        81.27            0.00
                                               ----------      ----------
                                  TOTAL           408.42          275.56

                  TOTAL SITE ENERGY        683.97 MBTU    146.6 KBTU/SQFT-YR GROSS-AREA    146.6 KBTU/SQFT-YR NET-AREA
                  TOTAL SOURCE ENERGY     1502.03 MBTU    321.9 KBTU/SQFT-YR GROSS-AREA    321.9 KBTU/SQFT-YR NET-AREA
                  PERCENT OF HOURS ANY SYSTEM ZONE OUTSIDE OF THROTTLING RANGE =  3.3
                  PERCENT OF HOURS ANY PLANT LOAD NOT SATISFIED                =  0.0
                  NOTE  ELECTRICITY AND/OR FUEL USED TO GENERATE ELECTRICITY IS APPORTIONED BASED
                        ON THE YEARLY DEMAND.  ALL OTHER ENERGY TYPES ARE APPORTIONED HOURLY.
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EMC ENGINEERS INC. EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/ 4/1995 9:27:18 SDL RUN 1
DENVER, CO 80227 PROPOSED MODIFICATION FOR BLDG. #5000 FIRE STATION
REPORT- SS-A SYSTEM MONTHLY LOADS SUMMARY FOR ZONE_#1 TOPEKA, KS

MONTH	COOLING: COOLING ENERGY (MBTU)	COOLING: TIME OF MAX DY	COOLING: TIME OF MAX HR	COOLING: DRY-BULB TEMP	COOLING: WET-BULB TEMP	COOLING: MAXIMUM COOLING LOAD (KBTU/HR)	HEATING: HEATING ENERGY (MBTU)	HEATING: TIME OF MAX DY	HEATING: TIME OF MAX HR	HEATING: DRY-BULB TEMP	HEATING: WET-BULB TEMP	HEATING: MAXIMUM HEATING LOAD (KBTU/HR)	ELEC: ELEC-TRICAL ENERGY (KWH)	ELEC: MAXIMUM ELEC LOAD (KW)
JAN	0.00000					0.000	-6.465	4	3	8.F	7.F	-41.538	1515.	3.046
FEB	0.00000					0.000	-4.102	2	3	13.F	11.F	-30.609	1367.	3.038
MAR	0.00000					0.000	-3.097	3	4	16.F	13.F	-32.046	1511.	3.042
APR	0.00000					0.000	-0.549	5	5	31.F	29.F	-13.283	1452.	3.028
MAY	6.33590	16	2	62.F	59.F	59.468	0.000					0.000	2399.	8.633
JUN	13.15873	19	17	87.F	76.F	39.691	0.000					0.000	3316.	8.124
JUL	15.94538	1	16	86.F	80.F	42.436	0.000					0.000	3699.	9.106
AUG	16.51320	24	17	95.F	77.F	47.403	0.000					0.000	3828.	9.487
SEP	11.49475	5	17	90.F	77.F	49.259	0.000					0.000	3093.	9.421
OCT	0.33787	1	17	85.F	68.F	34.725	-0.117	31	7	43.F	39.F	-13.730	1546.	7.564
NOV	0.00000					0.000	-1.000	2	4	17.F	15.F	-18.416	1459.	3.029
DEC	0.00000					0.000	-5.796	14	7	10.F	8.F	-30.497	1514.	3.044
TOTAL	63.786						-21.126						26699.	
MAX						59.468						-41.538		9.487

D1-28

EMC ENGINEERS INC. EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/ 4/1995 9:27:18 SDL RUN 1
DENVER, CO 80227 PROPOSED MODIFICATION FOR BLDG. #5000 FIRE STATION
REPORT- SS-C SYSTEM MONTHLY LOAD HOURS FOR ZONE_#1 TOPEKA, KS

MONTH	HOURS COOLING LOAD	HOURS HEATING LOAD	HOURS COINCIDENT COOL-HEAT LOAD	HOURS FLOATING	HOURS HEATING AVAIL.	HOURS COOLING AVAIL.	HOURS FANS ON	HOURS FANS CYCLE ON	HOURS NIGHT VENTING	HOURS FLOATING WHEN FANS ON	COINCIDENT LOADS: HEATING LOAD AT COOLING PEAK (KBTU/HR)	COINCIDENT LOADS: ELECTRIC LOAD AT COOLING PEAK (KW)
JAN	0	499	0	245	744	0	744	0	0	245	0.000	0.050
FEB	0	426	0	246	672	0	672	0	0	246	0.000	0.050
MAR	0	309	0	435	744	0	744	0	0	435	-5.824	0.055
APR	0	88	0	632	720	0	720	0	0	632	0.000	0.050
MAY	366	0	0	378	360	384	744	0	0	378	0.000	6.050
JUN	708	0	0	12	0	720	720	0	0	12	0.000	8.124
JUL	744	0	0	0	0	744	744	0	0	0	0.000	8.315
AUG	744	0	0	0	0	744	744	0	0	0	0.000	9.487
SEP	644	0	0	76	0	720	720	0	0	76	0.000	9.325
OCT	16	20	0	708	720	24	744	0	0	708	0.000	7.564
NOV	0	128	0	592	720	0	720	0	0	592	-6.645	0.056
DEC	0	490	0	254	744	0	744	0	0	254	-9.749	0.058
ANNUAL	3222	1960	0	3578	5424	3336	8760	0	0	3578		

EMC ENGINEERS INC. EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/ 4/1995 9:27:18 SDL RUN 1
DENVER, CO 80227 PROPOSED MODIFICATION FOR BLDG. #5000 FIRE STATION
REPORT- SS-A SYSTEM MONTHLY LOADS SUMMARY FOR ZONE_#2 TOPEKA, KS

MONTH	COOLING ENERGY (MBTU)	COOLING TIME OF MAX DY	COOLING TIME OF MAX HR	COOLING DRY-BULB TEMP	COOLING WET-BULB TEMP	MAXIMUM COOLING LOAD (KBTU/HR)	HEATING ENERGY (MBTU)	HEATING TIME OF MAX DY	HEATING TIME OF MAX HR	HEATING DRY-BULB TEMP	HEATING WET-BULB TEMP	MAXIMUM HEATING LOAD (KBTU/HR)	ELEC-TRICAL ENERGY (KWH)	MAXIMUM ELEC LOAD (KW)
JAN	0.00000					0.000	-4.038	4	3	8.F	7.F	-32.541	2508.	9.867
FEB	0.00000					0.000	-2.081	2	3	13.F	11.F	-23.751	2264.	9.862
MAR	0.00000					0.000	-1.091	3	4	16.F	13.F	-24.578	2505.	9.862
APR	0.00000					0.000	-0.023	1	4	40.F	36.F	-5.143	2415.	9.862
MAY	7.90755	16	4	60.F	58.F	78.780	0.000					0.000	3572.	16.156
JUN	15.53830	19	19	86.F	75.F	51.151	0.000					0.000	4552.	15.802
JUL	17.62762	2	19	84.F	77.F	50.984	0.000					0.000	4891.	15.969
AUG	17.34673	24	19	92.F	76.F	53.226	0.000					0.000	4929.	16.104
SEP	12.40501	5	19	87.F	76.F	51.071	0.000					0.000	4190.	15.756
OCT	0.33720	1	18	83.F	68.F	38.998	-0.016	2	5	55.F	53.F	-5.415	2544.	14.171
NOV	0.00000					0.000	-0.207	2	5	16.F	15.F	-12.883	2422.	9.862
DEC	0.00000					0.000	-3.115	15	5	8.F	7.F	-24.172	2508.	9.866
TOTAL	71.162						-10.571						39300.	
MAX						78.780						-32.541		16.156

D1-29

EMC ENGINEERS INC. EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/ 4/1995 9:27:18 SDL RUN 1
DENVER, CO 80227 PROPOSED MODIFICATION FOR BLDG. #5000 FIRE STATION
REPORT- SS-C SYSTEM MONTHLY LOAD HOURS FOR ZONE_#2 TOPEKA, KS

MONTH	HOURS COOLING LOAD	HOURS HEATING LOAD	HOURS COINCIDENT COOL-HEAT LOAD	HOURS FLOATING	HOURS HEATING AVAIL.	HOURS COOLING AVAIL.	HOURS FANS ON	HOURS FANS CYCLE ON	HOURS NIGHT VENTING	HOURS FLOATING WHEN FANS ON	COINCIDENT LOADS: HEATING LOAD AT COOLING PEAK (KBTU/HR)	COINCIDENT LOADS: ELECTRIC LOAD AT COOLING PEAK (KW)
JAN	0	395	0	349	744	0	744	0	0	349	0.000	0.050
FEB	0	290	0	382	672	0	672	0	0	382	0.000	0.050
MAR	0	141	0	603	744	0	744	0	0	603	0.000	0.050
APR	0	7	0	713	720	0	720	0	0	713	0.000	0.050
MAY	379	0	0	365	360	384	744	0	0	365	0.000	7.776
JUN	717	0	0	3	0	720	720	0	0	3	0.000	15.552
JUL	744	0	0	0	0	744	744	0	0	0	0.000	15.388
AUG	744	0	0	0	0	744	744	0	0	0	0.000	16.104
SEP	673	0	0	47	0	720	720	0	0	47	0.000	15.587
OCT	18	4	0	722	720	24	744	0	0	722	0.000	14.171
NOV	0	46	0	674	720	0	720	0	0	674	-4.064	0.053
DEC	0	353	0	391	744	0	744	0	0	391	-4.395	0.054
ANNUAL	3275	1236	0	4249	5424	3336	8760	0	0	4249		

EMC ENGINEERS INC. EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/ 4/1995 9:27:18 SDL RUN 1
DENVER, CO 80227 PROPOSED MODIFICATION FOR BLDG. #5000 FIRE STATION
REPORT- SS-A SYSTEM MONTHLY LOADS SUMMARY FOR ZONE_#3 TOPEKA, KS

	COOLING						HEATING						ELEC	
MONTH	COOLING ENERGY (MBTU)	TIME OF MAX DY	TIME OF MAX HR	DRY-BULB TEMP	WET-BULB TEMP	MAXIMUM COOLING LOAD (KBTU/HR)	HEATING ENERGY (MBTU)	TIME OF MAX DY	TIME OF MAX HR	DRY-BULB TEMP	WET-BULB TEMP	MAXIMUM HEATING LOAD (KBTU/HR)	ELEC-TRICAL ENERGY (KWH)	MAXIMUM ELEC LOAD (KW)
JAN	0.00000					0.000	-2.108	4	3	8.F	7.F	-23.633	1922.	3.367
FEB	0.00000					0.000	-0.956	1	23	17.F	15.F	-16.552	1736.	3.364
MAR	0.00000					0.000	-0.748	3	4	16.F	13.F	-18.185	1921.	3.366
APR	0.00000					0.000	-0.019	1	4	40.F	36.F	-2.321	1850.	3.360
MAY	6.16714	16	4	60.F	58.F	54.976	0.000					0.000	2680.	8.285
JUN	11.82910	19	17	87.F	76.F	30.405	0.000					0.000	3343.	6.976
JUL	13.72206	1	16	86.F	80.F	32.375	0.000					0.000	3612.	7.459
AUG	13.76612	24	19	92.F	76.F	35.120	0.000					0.000	3664.	7.713
SEP	10.16607	5	17	90.F	77.F	35.248	0.000					0.000	3177.	7.654
OCT	0.28569	1	17	85.F	68.F	22.645	-0.004	2	5	55.F	53.F	-1.852	1951.	6.188
NOV	0.00000					0.000	0.000					0.000	1857.	3.359
DEC	0.00000					0.000	-1.493	8	13	20.F	17.F	-18.379	1922.	3.367
TOTAL	55.936						-5.328						29637.	
MAX						54.976						-23.633		8.285

EMC ENGINEERS INC. EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/ 4/1995 9:27:18 SDL RUN 1
DENVER, CO 80227 PROPOSED MODIFICATION FOR BLDG. #5000 FIRE STATION
REPORT- SS-C SYSTEM MONTHLY LOAD HOURS FOR ZONE_#3 TOPEKA, KS

	NUMBER OF HOURS										COINCIDENT LOADS	
MONTH	HOURS COOLING LOAD	HOURS HEATING LOAD	HOURS COINCIDENT COOL-HEAT LOAD	HOURS FLOATING	HOURS HEATING AVAIL.	HOURS COOLING AVAIL.	HOURS FANS ON	HOURS FANS CYCLE ON	HOURS NIGHT VENTING	HOURS FLOATING WHEN FANS ON	HEATING LOAD AT COOLING PEAK (KBTU/HR)	ELECTRIC LOAD AT COOLING PEAK (KW)
JAN	0	281	0	463	744	0	744	0	0	463	0.000	1.030
FEB	0	199	0	473	672	0	672	0	0	473	0.000	1.030
MAR	0	138	0	606	744	0	744	0	0	606	0.000	1.030
APR	0	11	0	709	720	0	720	0	0	709	0.000	1.030
MAY	384	0	0	360	360	384	744	0	0	360	0.000	6.197
JUN	720	0	0	0	0	720	720	0	0	0	0.000	6.976
JUL	744	0	0	0	0	744	744	0	0	0	0.000	7.092
AUG	744	0	0	0	0	744	744	0	0	0	0.000	7.662
SEP	712	0	0	8	0	720	720	0	0	8	0.000	7.559
OCT	24	3	0	717	720	24	744	0	0	717	0.000	6.188
NOV	0	0	0	720	720	0	720	0	0	720	0.000	1.030
DEC	0	220	0	524	744	0	744	0	0	524	0.000	1.030
ANNUAL	3328	852	0	4580	5424	3336	8760	0	0	4580		

MO	UTILITY-	ELECTRICITY	NATURAL-GAS
	TOTAL(MBTU)	20.301	21.376
JAN	PEAK(KBTU)	55.568	143.380
	DY/HR	14/12	4/ 3
	TOTAL(MBTU)	18.325	13.058
FEB	PEAK(KBTU)	55.490	106.222
	DY/HR	8/12	2/ 3
	TOTAL(MBTU)	20.274	9.599
MAR	PEAK(KBTU)	55.514	112.310
	DY/HR	13/12	3/ 4
	TOTAL(MBTU)	19.519	2.703
APR	PEAK(KBTU)	55.473	31.580
	DY/HR	4/12	5/ 5
	TOTAL(MBTU)	29.537	1.786
MAY	PEAK(KBTU)	112.486	2.400
	DY/HR	16/12	31/ 1
	TOTAL(MBTU)	38.280	1.728
JUN	PEAK(KBTU)	103.401	2.400
	DY/HR	19/19	30/ 1
	TOTAL(MBTU)	41.664	1.786
JUL	PEAK(KBTU)	108.516	2.400
	DY/HR	23/18	31/ 1
	TOTAL(MBTU)	42.414	1.786
AUG	PEAK(KBTU)	112.659	2.400
	DY/HR	24/19	31/ 1
	TOTAL(MBTU)	35.715	1.728
SEP	PEAK(KBTU)	110.535	2.400
	DY/HR	5/18	30/ 1
	TOTAL(MBTU)	20.625	2.016
OCT	PEAK(KBTU)	93.906	26.008
	DY/HR	1/18	2/ 5
	TOTAL(MBTU)	19.592	3.703
NOV	PEAK(KBTU)	55.484	50.330
	DY/HR	1/12	2/ 4
	TOTAL(MBTU)	20.295	18.116
DEC	PEAK(KBTU)	55.541	105.566
	DY/HR	29/12	8/10
	ONE YEAR	326.541	79.383
	USE/PEAK	112.659	143.380

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    EMC     ENGINEERS      INC.      EZDOE - ELITE SOFTWARE DEVELOPMENT INC       DOE-2.1D   2/ 4/1995     9:27:18  PDL RUN 1
     DENVER,      CO       80227     PROPOSED MODIFICATION FOR BLDG. #5000   FIRE STATION
REPORT- BEPS  ESTIMATED BUILDING ENERGY PERFORMANCE                                 TOPEKA, KS
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                                  ENERGY TYPE
                                  IN SITE MBTU -  ELECTRICITY     NATURAL-GAS
                                 CATEGORY OF USE
                                    SPACE HEAT         0.00           79.38
                                    SPACE COOL        83.40            0.00
                                    HVAC AUX           8.99            0.00
                                    DOM HOT WTR        0.00            0.00
                                    AUX SOLAR          0.00            0.00
                                    LIGHTS           152.87            0.00
                                    VERT TRANS         0.00            0.00
                                    MISC EQUIP        81.27            0.00
                                                  ----------      ----------
                                     TOTAL           326.52           79.38

                     TOTAL SITE ENERGY       405.92 MBTU     87.0 KBTU/SQFT-YR GROSS-AREA     87.0 KBTU/SQFT-YR NET-AREA
                     TOTAL SOURCE ENERGY    1059.99 MBTU    227.1 KBTU/SQFT-YR GROSS-AREA    227.1 KBTU/SQFT-YR NET-AREA
                     PERCENT OF HOURS ANY SYSTEM ZONE OUTSIDE OF THROTTLING RANGE =  0.4
                     PERCENT OF HOURS ANY PLANT LOAD NOT SATISFIED                =  0.0
                     NOTE  ELECTRICITY AND/OR FUEL USED TO GENERATE ELECTRICITY IS APPORTIONED BASED
                           ON THE YEARLY DEMAND.  ALL OTHER ENERGY TYPES ARE APPORTIONED HOURLY.
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LENNOX®

ENGINEERING DATA

GAS FURNACES

G21Q "PULSE21™" SERIES UP-FLO GAS FURNACES

*93.2% to 96.2% A.F.U.E.

40,000 to 100,000 Btuh Input

Add-On Cooling — 1-1/2 thru 5 Nominal Tons

*Isolated Combustion System Rating for Non-Weatherized Furnaces

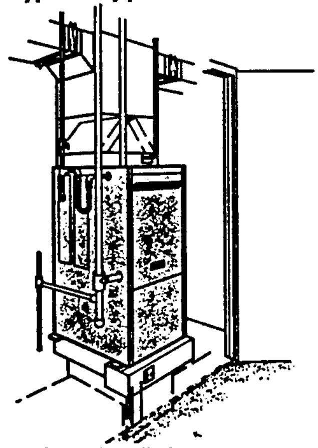
G21Q

Bulletin #480175
March 1992
Supersedes
February 1992
November 1991

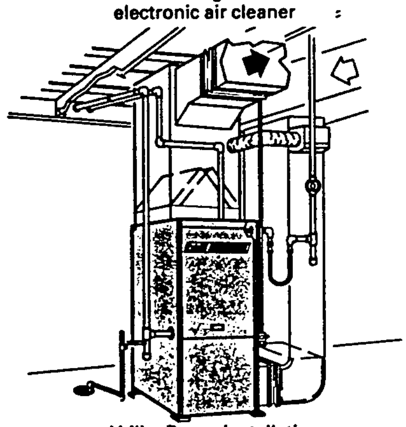
DESIGN AMERICAN GAS ASSOCIATION CERTIFIED

EFFICIENCY RATING CERTIFIED GAMA

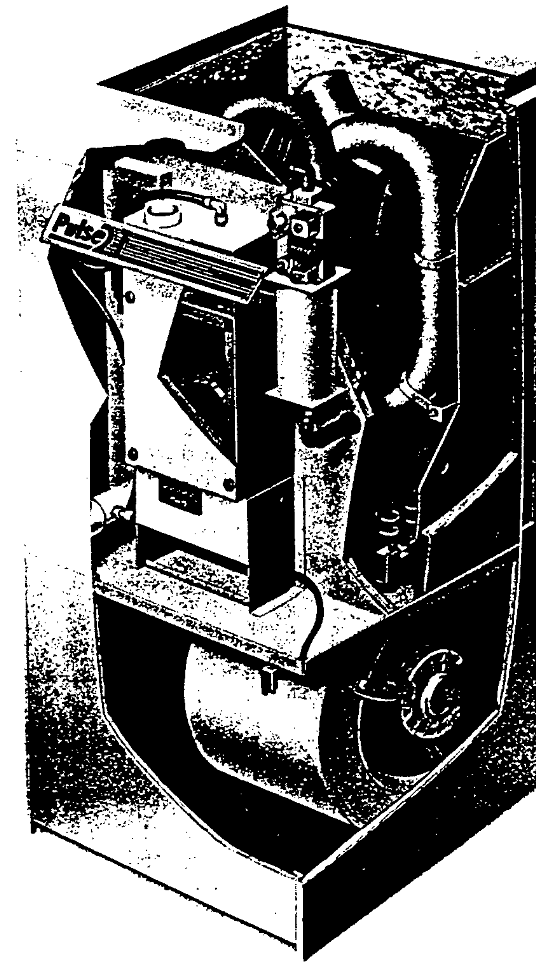
Typical Applications



Closet Installation
With cooling coil and
electronic air cleaner



Utility Room Installation
With cooling coil, return air
cabinet and humidifier



6-14

Application — Lennox G21 series gas furnaces are available in eight models (natural gas or LPG) with input capacities of 40,000, 60,000, 80,000 and 100,000 Btuh. Units operate on the pulse combustion principle and do not require conventional pilot burner, main burners, flue or chimney. Standard size cabinet with side or bottom return air entry permits installation in a basement, utility room or closet. Lennox add-on evaporator coils, electronic air cleaners and power humidifiers can easily be added for a total comfort all-season system. Replacement of furnaces manufactured by Lennox in the last twenty-five years can be done with only minor modification to duct work or add-on coils.

High efficiency of the G21 series is achieved with a unique heat exchanger design which features: finned cast iron combustion chamber, temperature resistant steel tailpipe, aluminized steel exhaust decoupler section and a finned stainless steel tube condenser coil. Moisture, during the process of combustion, is condensed in the coil, extracting almost every usable Btu out of the gas. Most of the combustion heat is utilized in the heat transfer from the coil, producing flue vent temperatures as low as 100F to 130F which allows the use of PVC (polyvinyl chloride) pipe for venting. Furnace can be vented through a side wall, roof or to the top of an existing chimney with up to 35 ft. of PVC pipe and up to four 90 degree elbows. Condensate created in the coil (PH ranges from 4.0 to 6.0) is not harmful to standard household plumbing and can be drained into city sewers and septic tanks without damage.

The G21 furnace has no pilot light or burners. An automotive type spark plug is used for ignition on the initial cycle only, saving gas and electrical energy. In the pulse combustion process, the use of atmospheric burners is eliminated, with combustion confined to heat exchanger combustion chamber. Sealed combustion system virtually eliminates the loss of conditioned air due to combustion and stack dilution. Combustion air is piped to the furnace with same type PVC pipe as used for exhaust gases.

Furnace is equipped with standard type redundant gas valve in series with gas expansion tank and gas intake flapper valve. Also factory installed are an air intake flapper valve, purge blower, spark plug igniter, flame sensor with solid-state control, solid-state blower control, limit control, high and low voltage terminal strip, 30VA transformer and cleanable air filter. Furnished for field installation are a flexible gas line connector, (4) isolation mounting pads, base insulation pad and condensate drip leg.

Optional equipment available: flue vent/air intake line roof or wall termination installation kits, LPG conversion kits, mufflers, furnace twinning kit, continous low speed blower kit, external filter mounting kit and thermostat.

G21 units are shipped completely factory assembled with all controls installed and wired. Units are test fired at the factory before shipment.

NOTE — Specifications, Ratings and Dimensions subject to change without notice.

Zone #3

SPECIFICATIONS

Model No.		G21Q3-40	G21Q3-60	G21Q4-60
Input Btuh		40,000	60,000	60,000
Output Btuh		38,000	55,000	55,000
*A.F.U.E.		96.2%	94.1%	94.1%
California Seasonal Efficiency		90.7%	89.9%	88.8%
Temperature rise range (°F)		35 — 65	40 — 70	35 — 65
High static certified by A.G.A. (in wg.)		.50	.50	.50
Gas Piping Size I.P.S. (in.)	Natural	1/2	1/2	1/2
	**LPG	1/2	1/2	1/2
Vent/Intake air pipe size connection (in.)		2	2	2
Condensate drain connection (in.) SDR11		1/2	1/2	1/2
Blower wheel nominal diameter x width (in.)		10 x 8	10 x 8	11 x 9
Blower motor hp		1/3	1/3	1/2
Number and size of filters (in.)		(1) 16 x 25 x 1	(1) 16 x 25 x 1	(1) 16 x 25 x 1
Tons of cooling that can be added		1-1/2 — 3	1-1/2 — 3	2-1/2 — 4
Shipping weight (lbs.)		250	250	255
Number of packages in shipment		1	1	1
Electrical characteristics		120 volts — 60 hertz — 1 phase (less than 12 amps) All models		
**LPG kit (optional)		LB-83176CR (76H95)	LB-83176CE (66H97)	LB-83176CE (66H97)
Cont. Low Speed Blower Switch Kit (optional)		LB-83611A (90H79) (All models — not used with twinning kit)		
Furnace Twinning Kit (optional)		LB-63093CA (64H88) (All models)		
Cont. Low Speed Blower Switch (optional)		67H18 (All models — used with twinning kit only)		
External Filter Mounting Kit (optional)	Part No.	LB-81871CA (16H36)	LB-81871CA (16H36)	LB-81871CA (16H36)
	•Filter size (in.)	(1) 16 x 25 x 1	(1) 16 x 25 x 1	(1) 16 x 25 x 1

•Filter is not furnished with kit. Filter kit utilizes existing filter supplied with G21 unit.
*Annual Fuel Utilization Efficiency based on D.O.E. test procedures and according to F.T.C. labeling regulations. Isolated combustion system rating for non-weatherized furnaces.
**LPG kit must be ordered extra for field changeover.

Zone #1 $2,680 List $2,145 contract

SPECIFICATIONS

Model No.		G21Q3-80	G21Q4-80	G21Q5-80	G21Q3-100	G21Q4/5-100
Input Btuh		80,000	80,000	80,000	100,000	100,000
Output Btuh		73,000	73,000	74,000	93,000	95,000
*A.F.U.E.		93.9%	93.9%	93.2%	94.0%	94.5%
California Seasonal Efficiency		90.1%	88.9%	88.3%	90.8%	89.6%
Temperature rise range (°F)		45 — 75	40 — 70	35 — 65	55 — 85	40 — 70
High static certified by A.G.A. (in wg.)		.50	.50	.50	.50	.50
Gas Piping Size I.P.S. (in.)	Natural	1/2	1/2	1/2	1/2	1/2
	**LPG	1/2	1/2	1/2	1/2	1/2
Vent/Intake air pipe size connection (in.)		2	2	2	2	2
Condensate drain connection (in.) SDR11		1/2	1/2	1/2	1/2	1/2
Blower wheel nominal diameter x width (in.)		10 x 8	11 x 9	12 x 12	10 x 8	12 x 12
Blower motor hp		1/3	1/2	3/4	1/2	3/4
Number and size of filters (in.)		(1) 16 x 25 x 1	(1) 16 x 25 x 1	(1) 20 x 25 x 1	(1) 20 x 25 x 1	(1) 20 x 25 x 1
Tons of cooling that can be added		2 — 3	2-1/2 — 4	4 or 5	2 — 3	3-1/2 — 5
Shipping weight (lbs.)		250	255	297	297	297
Number of packages in shipment		1	1	1	1	1
Electrical characteristics		120 volts — 60 hertz — 1 phase (less than 12 amps) All models				
**LPG kit (optional)		LB-83176CF (66H98)	LB-83176CF (66H98)	LB-83176CF (66H98)	LB-83176CP (73H62)	LB-83176CP (73H62)
Cont. Low Speed Blower Switch Kit (optional)		LB-83611A (90H79) (All models — not used with twinning kit)				
Furnace Twinning Kit (optional)		LB-63093CA (64H88) (All models)				
Cont. Low Speed Blower Switch (optional)		67H18 (All models — used with twinning kit only)				
External Filter Mounting Kit (optional)	Part No.	LB-81871CA (16H36)	LB-81871CA (16H36)	LB-81871CB (16H37)	LB-81871CB (16H37)	LB-81871CB (16H37)
	•Filter size (in.)	(1) 16 x 25 x 1	(1) 16 x 25 x 1	(1) 20 x 25 x 1	(1) 20 x 25 x 1	(1) 20 x 25 x 1

•Filter is not furnished with kit. Filter kit utilizes existing filter supplied with G21 unit.
*Annual Fuel Utilization Efficiency based on D.O.E. test procedures and according to F.T.C. labeling regulations. Isolated combustion system rating for non-weatherized furnaces.
**LPG kit must be ordered extra for field changeover.

BLOWER DATA

G21Q3-40, G21Q3-60 AND G21Q3-80 BLOWER PERFORMANCE

External Static Pressure (in. wg)	Air Volume @ Various Speeds		
	High	Medium	Low
0	1585	1392	920
.05	1558	1364	917
.10	1533	1354	915
.15	1505	1335	912
.20	1477	1315	905
.25	1447	1294	893
.30	1418	1272	887
.40	1355	1225	858
.50	1282	1164	803

NOTE — All cfm data is measured external to unit with the air filter in place.

G21Q4-60 AND G21Q4-80 BLOWER PERFORMANCE

External Static Pressure (in. wg)	Air Volume @ Various Speeds		
	High	Medium	Low
0	1793	1295	1050
.05	1770	1290	1050
.10	1747	1285	1050
.15	1724	1280	1050
.20	1700	1275	1050
.25	1675	1267	1050
.30	1648	1258	1050
.40	1585	1233	1036
.50	1517	1193	1012

NOTE — All cfm data is measured external to unit wtih the air filter in place.

G21Q5-80 BLOWER PERFORMANCE

External Static Pressure (in. wg)	Air Volume (cfm) @ Various Speeds				
	High	Med-High	Medium	Med-Low	Low
0	2460	2350	2155	1900	1695
.05	2430	2310	2130	1875	1675
.10	2395	2275	2100	1855	1655
.15	2355	2240	2065	1825	1625
.20	2315	2205	2035	1800	1600
.25	2275	2175	1995	1780	1570
.30	2235	2130	1960	1740	1540
.40	2155	2055	1880	1675	1480
.50	2070	1970	1790	1605	1410
.60	1980	1890	1710	1540	1345

NOTE — All cfm data is measured external to unit with the air filter in place.

G21Q3-100 BLOWER PERFORMANCE

External Static Pressure (in. wg)	Air Volume @ Various Speeds		
	High	Medium	Low
0	1850	1660	1500
.05	1805	1635	1470
.10	1760	1610	1440
.15	1720	1575	1420
.20	1680	1540	1400
.25	1635	1505	1375
.30	1590	1470	1350
.40	1500	1400	1290
.50	1400	1320	1220
.60	1290	1230	1140

NOTE — All cfm data is measured external to unit with the air filter in place.

G21Q4/5-100 BLOWER PERFORMANCE

External Static Pressure (in. wg)	Air Volume (cfm) @ Various Speeds				
	High	Med-High	Medium	Med-Low	Low
0	2450	2340	2140	1910	1690
.05	2420	2310	2110	1880	1670
.10	2390	2270	2080	1860	1640
.15	2350	2240	2050	1830	1620
.20	2320	2210	2020	1800	1590
.25	2280	2170	1990	1770	1570
.30	2250	2140	1960	1740	1540
.40	2180	2060	1890	1680	1480
.50	2100	1980	1810	1610	1420
.60	2005	1890	1740	1530	1350

NOTE — All cfm data is measured external to unit with the air filter in place.

D1-35

LENNOX®

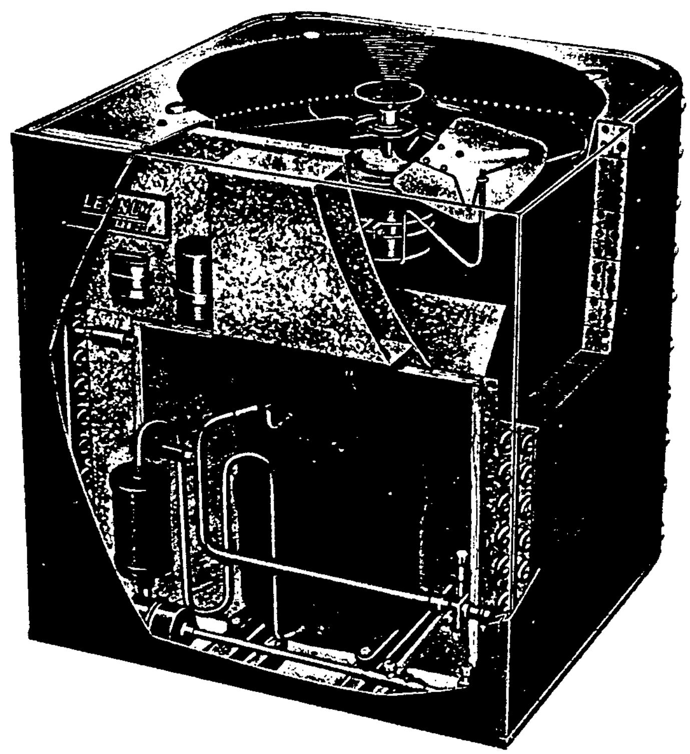
HS14 POWER SAVER® SERIES CONDENSING UNITS

*32,800 to 64,500 Btuh Cooling Capacity

*ARI Standard 210/240 and DOE Ratings

CERTIFICATION APPLIES ONLY WHEN THE COMPLETE SYSTEM IS LISTED WITH ARI

CERTIFICATION APPLIES ONLY WHEN THE COMPLETE SYSTEM IS LISTED WITH ARI

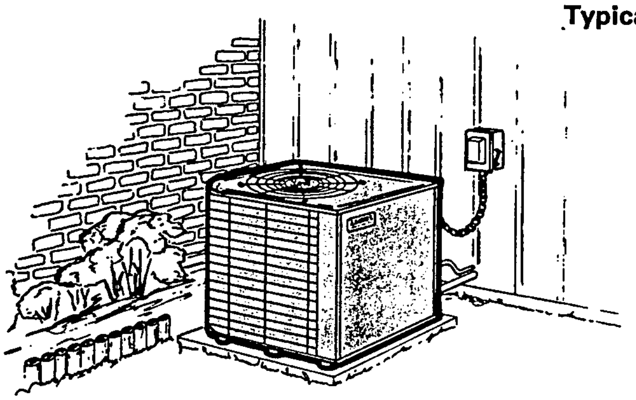


Application — The HS14 POWER SAVER line of remote condensing units offer seasonal energy efficiency ratios (SEER's) of up to 15.5 in 3, 4 and 5 ton sizes with a choice of single or three phase voltage power supply. These super efficient units are equipped with a two-speed compressor staged to deliver the precise cooling capacity desired with minimum operating costs. Compressor operates on low speed under light and medium loads and goes to high speed for heavy cooling loads. Vertical discharge of air allows concealment of the unit among shrubs on a slab at grade level or out of sight on a roof. A variety of matching blower powered or furnace add-on evaporator units provide a wide range of cooling capacities and application versatility. See ARI Ratings table. For evaporator unit data see tab section Coils-Blower Coil Units. Condensing units are shipped factory assembled, piped and wired. In addition, the units are test operated at the factory to ensure dependable, on the job performance. The installer has only to connect the refrigerant lines and make electrical connections.

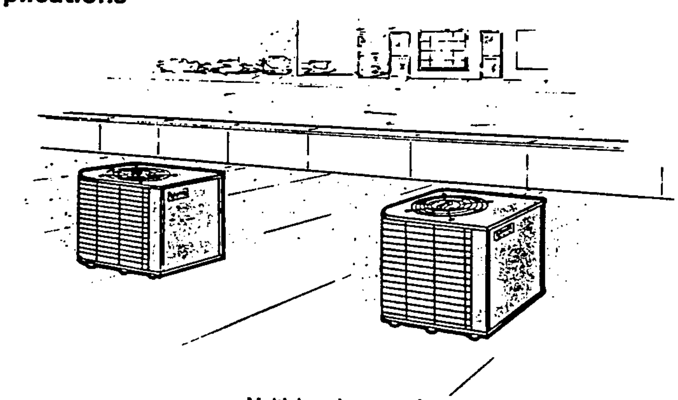
Approvals — Condensing units have been tested with matching evaporator units in the Lennox Research Laboratory environmental test room and rated according to U.S. Department of Energy (DOE) test procedures and in accordance with ARI Standard 210/240-89. In addition, units have been sound rated in the Lennox reverberant sound test room in accordance with ARI Standard 270-84. Condensing units and components within are bonded for grounding to meet safety standards for servicing required by U.L. and N.E.C. Units are also U.L. Listed.

Equipment Warranty — The compressor has a limited warranty for a full ten years in residential installations and five years in non-residential installations. All other components have a limited warranty for one year. Refer to Lennox Equipment Limited Warranty certificate included with the unit for specific details.

Typical Applications



Unit on slab at ground level.



Multiple units on rooftop

NOTE — Specifications, Ratings and Dimensions subject to change without notice.

LENNOX®

HS14 SERIES CONDENSING UNITS ARI/COOLING CAPACITY RATINGS WITH CH20-51 & CH20-65 EVAPORATOR UNITS

ARI RATINGS

Condensing Unit Model No. *ARI Standard 270 SRN (bels)	**ARI Standard 210/240 Ratings				Evaporator Unit			***Expansion Valve Kit
	SEER (Btuh/ Watts)	EER (Btuh/ Watts)	Cooling Capacity (Btuh)	Total Unit Watts	Up-Flo	Down-Flo	Horizontal	
HS14-411V-413V (7.6)	12.70	9.85	40,000	4060	----	----	CH20-51	LB-53081CA
HS14-511V-513V (7.6)	12.10	9.15	47,500	5175	----	----	CH20-51	LB-53081CB
HS14-511V-513V (7.6)	12.30	9.20	50,500	5480	----	----	CH20-65	LB-53081CB
HS14-651V-653V (7.8)	11.70	8.45	56,000	6610	----	----	CH20-51	LB-53081CC
HS14-651V-653V (7.8)	11.30	8.65	60,000	6945	----	----	CH20-65	LB-53081CC

*Sound Rating Number in accordance with ARI Standard 270.
**Rated in accordance with ARI Standard 210/240 and DOE; 95F outdoor air temperature, 80F db / 67F wb entering evaporator air with 25 ft. of connecting refrigerant lines.
***Kit is optional and must be ordered extra for field installation.

RATINGS

NOTE — To determine Sensible Capacity, Leaving Wet and Dry Bulb temperatures not shown in the tables, see Miscellaneous Engineering Data section, page 9.

HS14-411V-413V WITH CH20-51 EVAPORATOR UNIT (Low Speed Compressor Operation)

Enter. Wet Bulb (°F)	Total Air Vol. (cfm)	Outdoor Air Temperature Entering Condenser Coil (°F)																			
		75					85					95					105				
		Total Cool. Cap. (Btuh)	Comp. Motor Watts Input	Sensible To Total Ratio (S/T) Dry Bulb (°F)			Total Cool. Cap. (Btuh)	Comp. Motor Watts Input	Sensible To Total Ratio (S/T) Dry Bulb (°F)			Total Cool. Cap. (Btuh)	Comp. Motor Watts Input	Sensible To Total Ratio (S/T) Dry Bulb (°F)			Total Cool. Cap. (Btuh)	Comp. Motor Watts Input	Sensible To Total Ratio (S/T) Dry Bulb (°F)		
				75	80	85			75	80	85			75	80	85			75	80	85
63	1200	27,000	1300	.87	1.00	1.00	25,500	1460	.90	1.00	1.00	24,100	1620	.93	1.00	1.00	22,500	1790	.96	1.00	1.00
	1600	28,700	1280	.95	1.00	1.00	27,100	1450	.97	1.00	1.00	25,400	1630	1.00	1.00	1.00	23,600	1810	1.00	1.00	1.00
	2000	29,800	1280	1.00	1.00	1.00	28,000	1450	1.00	1.00	1.00	26,200	1630	1.00	1.00	1.00	24,100	1810	1.00	1.00	1.00
67	1200	28,300	1290	.67	.85	1.00	26,500	1450	.68	.88	1.00	24,700	1630	.69	.90	1.00	23,000	1800	.70	.94	1.00
	1600	29,200	1280	.70	.95	1.00	27,400	1450	.72	.96	1.00	25,600	1630	.73	.98	1.00	23,600	1810	.74	1.00	1.00
	2000	29,800	1280	.73	1.00	1.00	28,000	1450	.75	1.00	1.00	26,200	1630	.76	1.00	1.00	24,100	1810	.79	1.00	1.00
71	1200	29,600	1280	.48	.67	.83	27,800	1450	.47	.68	.85	25,900	1630	.47	.69	.88	24,000	1810	.48	.70	.92
	1600	30,600	1270	.48	.71	.91	28,600	1450	.49	.72	.95	26,400	1630	.49	.73	.98	24,300	1810	.49	.75	1.00
	2000	31,100	1270	.49	.74	.98	28,800	1450	.51	.75	1.00	26,600	1630	.50	.77	1.00	24,400	1810	.51	.81	1.00

NOTE — All values are gross capacities and do not include evaporator coil blower motor heat deduction.

HS14-411V-413V WITH CH20-51 EVAPORATOR UNIT (High Speed Compressor Operation)

Enter. Wet Bulb (°F)	Total Air Vol. (cfm)	Outdoor Air Temperature Entering Condenser Coil (°F)																			
		85					95					105					115				
		Total Cool. Cap. (Btuh)	Comp. Motor Watts Input	Sensible To Total Ratio (S/T) Dry Bulb (°F)			Total Cool. Cap. (Btuh)	Comp. Motor Watts Input	Sensible To Total Ratio (S/T) Dry Bulb (°F)			Total Cool. Cap. (Btuh)	Comp. Motor Watts Input	Sensible To Total Ratio (S/T) Dry Bulb (°F)			Total Cool. Cap. (Btuh)	Comp. Motor Watts Input	Sensible To Total Ratio (S/T) Dry Bulb (°F)		
				75	80	85			75	80	85			75	80	85			75	80	85
63	1200	41,300	3030	.73	.87	.98	39,300	3240	.76	.88	1.00	37,300	3450	.77	.90	1.00	35,100	3640	.78	.93	[illegible]
	1600	43,700	3100	.79	.93	1.00	41,700	3320	.80	.95	1.00	39,200	3530	.82	.98	1.00	37,000	3740	.83	1.00	[illegible]
	2000	45,200	3140	.83	.99	1.00	42,900	3370	.84	1.00	1.00	40,700	3600	.86	1.00	1.00	38,400	3820	.88	1.00	1.00
67	1200	43,500	3100	.58	.70	.84	41,400	3310	.58	.72	.85	39,100	3530	.60	.75	.87	37,000	3740	.62	.76	.89
	1600	45,900	3160	.62	.77	.90	43,600	3390	.63	.78	.92	41,200	3620	.63	.80	.95	38,800	3840	.64	.81	.98
	2000	47,600	3200	.64	.81	.97	45,100	3440	.64	.82	.99	42,500	3680	.65	.84	1.00	39,800	3900	.66	.86	1.00
71	1200	45,700	3150	.44	.56	.68	43,300	3380	.44	.57	.69	40,900	3610	.44	.58	.71	38,600	3830	.46	.61	.74
	1600	47,600	3210	.45	.60	.75	45,300	3450	.46	.62	.76	42,700	3690	.46	.62	.78	40,100	3910	.46	.63	.79
	2000	49,100	3250	.46	.63	.79	46,600	3490	.46	.64	.81	43,800	3730	.47	.65	.82	41,000	3950	.46	.66	.85

NOTE — All values are gross capacities and do not include evaporator coil blower motor heat deduction.

NOTE — Specifications and Ratings subject to change without notice.

RATINGS

NOTE — To determine sensible capacity, leaving wet bulb and dry bulb temperatures not shown in the tables, see Miscellaneous Engineering Data, page 9.

HS14-651V-653V WITH CH16-51FF EVAPORATOR UNIT
(Low Speed Compressor Operation)

Enter. Wet Bulb (°F)	Total Air Vol. (cfm)	Outdoor Air Temperature Entering Condenser Coil (°F)																			
		75					85					95					105				
		Total Cool Cap. (Btuh)	Comp. Motor Watts Input	Sensible To Total Ratio (S/T) Dry Bulb (°F)			Total Cool Cap. (Btuh)	Comp. Motor Watts Input	Sensible To Total Ratio (S/T) Dry Bulb (°F)			Total Cool Cap. (Btuh)	Comp. Motor Watts Input	Sensible To Total Ratio (S/T) Dry Bulb (°F)			Total Cool Cap. (Btuh)	Comp. Motor Watts Input	Sensible To Total Ratio (S/T) Dry Bulb (°F)		
				75	80	85			75	80	85			75	80	85			75	80	85
63	1500	39,500	2020	.77	.95	1.00	37,600	2320	.79	.98	1.00	35,800	2640	.81	1.00	1.00	34,000	2990	.83	1.00	1.00
	2000	42,400	1990	.85	1.00	1.00	40,600	2300	.88	1.00	1.00	38,700	2650	.92	1.00	1.00	36,700	3020	.96	1.00	1.00
	2500	44,900	1960	.91	1.00	1.00	42,900	2290	.98	1.00	1.00	40,700	2650	1.00	1.00	1.00	38,500	3030	1.00	1.00	1.00
67	1500	41,900	1990	.59	.75	.90	40,000	2300	.60	.76	.93	37,800	2650	.62	.78	.97	35,600	3010	.63	.81	1.00
	2000	44,200	1970	.64	.83	1.00	42,100	2290	.66	.85	1.00	39,700	2640	.69	.88	1.00	37,400	3030	.70	.92	1.00
	2500	45,700	1950	.70	.92	1.00	43,200	2280	.72	.96	1.00	41,000	2640	.74	.98	1.00	38,500	3040	.76	1.00	1.00
71	1500	44,600	1970	.43	.58	.72	42,500	2280	.44	.59	.74	40,200	2640	.44	.60	.76	37,800	3030	.45	.62	.78
	2000	46,900	1940	.45	.67	.80	44,400	2270	.46	.65	.82	41,900	2640	.47	.67	.85	39,400	3050	.48	.69	.89
	2500	48,100	1930	.48	.69	.89	45,500	2270	.50	.71	.92	43,000	2650	.50	.73	.96	40,400	3060	.51	.75	.99

NOTE — All values are gross capacities and do not include evaporator coil blower motor heat deduction.

HS14-651V-653V WITH CH16-51FF EVAPORATOR UNIT
(High Speed Compressor Operation)

Enter. Wet Bulb (°F)	Total Air Vol. (cfm)	Outdoor Air Temperature Entering Condenser Coil (°F)																			
		85					95					105					115				
		Total Cool Cap. (Btuh)	Comp. Motor Watts Input	Sensible To Total Ratio (S/T) Dry Bulb (°F)			Total Cool Cap. (Btuh)	Comp. Motor Watts Input	Sensible To Total Ratio (S/T) Dry Bulb (°F)			Total Cool Cap. (Btuh)	Comp. Motor Watts Input	Sensible To Total Ratio (S/T) Dry Bulb (°F)			Total Cool Cap. (Btuh)	Comp. Motor Watts Input	Sensible To Total Ratio (S/T) Dry Bulb (°F)		
				75	80	85			75	80	85			75	80	85			75	80	85
63	1500	59,000	5560	.67	.79	.92	56,200	5990	.68	.81	.94	53,400	6420	.69	.83	.96	50,400	6830	.71	.86	.99
	2000	63,500	5710	.72	.87	1.00	60,400	6170	.74	.89	1.00	57,300	6620	.76	.92	1.00	53,700	7060	.78	.95	1.00
	2500	66,200	5810	.77	.94	1.00	63,300	6290	.79	.97	1.00	59,700	6760	.82	.99	1.00	56,300	7230	.85	1.00	1.00
67	1500	62,900	5690	.54	.64	.75	60,000	6140	.54	.65	.77	56,900	6600	.55	.67	.79	53,700	7050	.56	.68	.82
	2000	67,300	5840	.56	.69	.83	63,900	6320	.57	.71	.85	60,500	6800	.58	.73	.88	57,000	7280	.60	.75	.91
	2500	70,100	5940	.59	.75	.91	66,700	6440	.60	.77	.93	63,200	6950	.62	.79	.96	59,500	7440	.63	.82	.99
71	1500	66,800	5820	.41	.52	.62	63,700	6300	.42	.52	.63	60,400	6790	.42	.53	.64	57,200	7280	.42	.54	.66
	2000	71,400	5980	.42	.55	.67	67,900	6490	.43	.56	.68	64,300	7010	.43	.57	.70	60,600	7520	.44	.58	.72
	2500	74,300	6080	.44	.58	.72	70,700	6610	.44	.59	.74	66,800	7150	.45	.61	.76	62,900	7670	.45	.62	.79

NOTE — All values are gross capacities and do not include evaporator coil blower motor heat deduction.

HS14-651V-653V WITH CR16-51FF EVAPORATOR UNIT
(Low Speed Compressor Operation)

Enter. Wet Bulb (°F)	Total Air Vol. (cfm)	Outdoor Air Temperature Entering Condenser Coil (°F)																			
		75					85					95					105				
		Total Cool Cap. (Btuh)	Comp. Motor Watts Input	Sensible To Total Ratio (S/T) Dry Bulb (°F)			Total Cool Cap. (Btuh)	Comp. Motor Watts Input	Sensible To Total Ratio (S/T) Dry Bulb (°F)			Total Cool Cap. (Btuh)	Comp. Motor Watts Input	Sensible To Total Ratio (S/T) Dry Bulb (°F)			Total Cool Cap. (Btuh)	Comp. Motor Watts Input	Sensible To Total Ratio (S/T) Dry Bulb (°F)		
				75	80	85			75	80	85			75	80	85			75	80	85
63	1500	36,400	2040	.73	.90	1.00	34,600	2330	.75	.92	1.00	32,600	2630	.76	.96	1.00	30,900	2940	.78	.98	1.00
	2000	38,700	2030	.79	.99	1.00	36,900	2320	.81	1.00	1.00	35,200	2640	.84	1.00	1.00	33,400	2980	.87	1.00	1.00
	2500	40,900	2000	.86	1.00	1.00	39,100	2310	.89	1.00	1.00	37,300	2650	.92	1.00	1.00	35,300	3000	.96	1.00	1.00
67	1500	38,900	2030	.57	.71	.85	37,100	2320	.58	.72	.87	35,100	2640	.59	.74	.90	33,000	2970	.60	.76	.94
	2000	41,100	2000	.61	.76	.95	39,100	2310	.62	.78	.98	36,900	2650	.63	.81	1.00	34,600	3000	.64	.84	1.00
	2500	42,600	1990	.64	.83	1.00	40,400	2300	.65	.86	1.00	38,200	2650	.67	.89	1.00	35,500	3010	.68	.93	1.00
71	1500	41,600	2000	.43	.56	.68	39,600	2310	.43	.57	.69	37,500	2650	.44	.58	.71	35,300	3000	.44	.59	.73
	2000	43,700	1980	.44	.60	.74	41,600	2290	.45	.61	.76	39,400	2640	.45	.62	.78	37,000	3020	.46	.63	.81
	2500	45,400	1950	.46	.63	.80	43,100	2280	.46	.64	.83	40,600	2640	.47	.66	.86	38,100	3040	.48	.68	.89

NOTE — All values are gross capacities and do not include evaporator coil blower motor heat deduction.

HS14-651V-653V WITH CR16-51FF EVAPORATOR UNIT
(High Speed Compressor Operation)

Enter. Wet Bulb (°F)	Total Air Vol. (cfm)	Outdoor Air Temperature Entering Condenser Coil (°F)																			
		85					95					105					115				
		Total Cool Cap. (Btuh)	Comp. Motor Watts Input	Sensible To Total Ratio (S/T) Dry Bulb (°F)			Total Cool Cap. (Btuh)	Comp. Motor Watts Input	Sensible To Total Ratio (S/T) Dry Bulb (°F)			Total Cool Cap. (Btuh)	Comp. Motor Watts Input	Sensible To Total Ratio (S/T) Dry Bulb (°F)			Total Cool Cap. (Btuh)	Comp. Motor Watts Input	Sensible To Total Ratio (S/T) Dry Bulb (°F)		
				75	80	85			75	80	85			75	80	85			75	80	85
63	1500	54,900	5410	.66	.77	.88	52,300	5820	.67	.78	.90	49,600	6210	.68	.80	.92	46,700	6580	.69	.82	.94
	2000	59,200	5570	.69	.82	.95	56,300	5990	.70	.84	.97	53,200	6410	.72	.86	.99	49,900	6810	.74	.89	1.00
	2500	62,200	5670	.73	.87	1.00	58,900	6110	.74	.90	1.00	55,900	6540	.76	.92	1.00	52,600	6960	.78	.95	1.00
67	1500	58,600	5540	.53	.63	.73	55,900	5970	.54	.64	.74	53,000	6400	.54	.65	.76	50,000	6800	.55	.66	.78
	2000	63,200	5700	.55	.66	.78	60,100	6160	.56	.68	.80	56,900	6610	.57	.69	.82	53,500	7040	.58	.71	.85
	2500	66,300	5810	.57	.70	.84	63,000	6280	.58	.71	.86	59,500	6750	.59	.73	.88	55,900	7200	.60	.75	.91
71	1500	62,200	5660	.41	.51	.60	59,400	6120	.41	.52	.61	56,400	6580	.41	.52	.62	53,300	7030	.41	.53	.64
	2000	67,000	5830	.42	.53	.64	63,800	6320	.42	.54	.65	60,400	6800	.42	.55	.66	56,900	7270	.43	.56	.68
	2500	70,300	5940	.43	.56	.67	66,800	6450	.43	.57	.69	63,200	6950	.44	.58	.71	59,500	7450	.44	.59	.73

NOTE — All values are gross capacities and do not include evaporator coil blower motor heat deduction.

E M C ENGINEERS, INC.
2750 S. Wadsworth Blvd.
Suite C-200
Denver, CO 80227
(303) 988-2951

9755 Dogwood Rd.
Suite 220
Roswell, GA 30075
(404) 642-1864

JOB 1406.005 HVAC Upgrade - Ft Riley, KS
SHEET NO. ______ OF ______
CALCULATED BY C. Wohlert DATE 2/3/95
CHECKED BY ______ DATE ______
SCALE ______

Price Quote for F.A.C.s

Lennox

Contact: Tim Nelson

Model No.	List Price	Cooling capacity	heating capacity
G20E	$1,840	4 tons	75,000 Btuh
G21Q	$2,680	5 tons	80,000 Btuh
	$2,600	5 tons	60,000 Btuh

BUILDING 7178
ANNUAL ENERGY SAVINGS SUMMARY

Item	Baseline	ECO	Annual Energy Savings	Adj. Annual Energy Savings*
Annual Electric (MBTU)	411.21	318.98	92.23	51.87
Annual Natural Gas (MBTU)			0.00	0.00
Electric Demand June (KW)	90.80	66.55	24.25	13.64
Electric Demand July (KW)	93.67	69.61	24.06	13.53
Electric Demand August (KW)	96.28	67.94	28.34	15.94

*Energy savings prorated on a square foot basis:

Baseline Model Bldg 7243 (sq.ft.)	4410
ECO Model Bldg 7178 (sq.ft.)	2480
Square Footage Adjustment Factor	0.562

LIFE CYCLE COST ANALYSIS SUMMARY
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

LOCATION:	Fort Riley	REGION: 2 (Kansas)		PROJECT NO:	1406-005
PROJECT TITLE:	Feasibility Study for HVAC Upgrade			FISCAL YEAR:	1995
ANALYSIS DATE:	05/04/95	ECONOMIC LIFE:	20	PREPARED BY:	C. Wohlert

1. INVESTMENT: **BLDG 7178 - Replace 3 Window ACs w/ 1SZ AHU**

A. CONSTRUCTION COST	=		$11,220	
B. SIOH COST	(5.5% of 1A) =		$617	
C. DESIGN COST	(6.0% of 1A) =		$673	
D. TOTAL COST	(1A +1B +1C) =		$12,511	
E. SALVAGE VALUE OF EXISTING EQUIPMENT =			$0	
F. PUBLIC UTILITY COMPANY REBATE =			$0	
G. TOTAL INVESTMENT	(1D -1E -1F) =		------->	$12,511

2. ENERGY SAVINGS (+) OR COST (-):

DATE OF NISTR 85-3273-9 USED FOR DISCOUNT FACTORS: JAN '95

ENERGY SOURCE	FUEL COST $/MBTU (1)	SAVINGS MBTU/YR (2)	ANNUAL $ SAVINGS (3)	DISCOUNT FACTOR (4)	DISCOUNTED SAVINGS (5)	
A. ELECT.	$12.10	52	$628	15.88	$9,967	
B. DIST	$0.00	0	$0	19.16	$0	
C. NAT GAS	$4.12	0	$0	18.30	$0	
D. COAL	$0.00	0	$0	16.62	$0	
E. ELEC. DEMAND			$826	14.88	$12,293	
F. TOTAL		52	$1,454		-------->	$22,259

3. NON-ENERGY SAVINGS (+) OR COST (-)

A. ANNUAL RECURRING (+/-)

1 ANNUAL MAINTENANCE	($141)	14.88	($2,094)	
2	$0	14.88	$0	
3	$0	14.88	$0	
4 TOTAL ANNUAL DISC. SAVINGS (+) / COST	($141)		($2,094)	

B. NON-RECURRING (+/-)

ITEM	SAVINGS (+) COST(-) (1)	YEAR OF OCCURRENCE (2)	DISCOUNT FACTOR (3) (TABLE A-2)	DISCOUNTED SAVINGS/COST (4)
a. BASELINE EQUIP. REPLCMNT.	$4,071	5	0.863	$3,513
b.				$0
c.				$0
d.				$0
e.				$0
f. TOTAL	$4,071			$3,513

C. TOTAL NON-ENERGY DISCOUNTED SAVINGS (+) OR COST (-) (3A4 + 3Bf4) = $1,419

4. FIRST YEAR DOLLAR SAVINGS (+) / COSTS (-)	(2F3+3A4+(3Bf1/Economic Life))	$1,517
5. SIMPLE PAYBACK (SPB) IN YEARS (MUST BE < 10 YEARS TO QUALIFY)	(1G/4) =	8.25
6. TOTAL NET DISCOUNTED SAVINGS	(2F5 + 3C) =	$23,679
7. DISCOUNTED SAVINGS-TO-INVESTMENT RATIO (SIR) (MUST HAVE SIR > 1.25 TO QUALIFY)	(6/1G) =	1.89

ENGINEER'S OPINION OF PROBABLE COST

PROJECT	Fort Riley Feasibility Study for HVAC Upgrade	**SHEET**	1 OF 1
ENGINEER	E M C Engineers, Inc.	**DATE PREPARED**	4-May-95
	Denver, CO	**ESTIMATOR**	C. Wohlert
		CHECKED BY	A. Niemeyer

Line No.	Item Refer Code	Item Description	Unit of Measure	MATERIAL COST Quantity	MATERIAL COST Unit Cost	MATERIAL COST Total	LABOR COST Crew/ Worker	LABOR COST Hours/ Unit	LABOR COST Total	TOTAL
1		**BUILDING 7178**								
2		**PROPOSED SYSTEM MODIFICATIONS**								
3										
4		*NEW SYSTEMS INSTALLATION*								
5	AHUH1300	1,300 CFM AHU	EA.	1.0	$2,296.53	$2,297	Q-5	13.9965	$271	$2,568
6	12X6SA	12X6 SA GRILLES	EA.	6.0	$9.84	$59	1-SHEE	0.348	$43	$102
7	DUCT500	GAL. STEEL DUCTWORK, 200 TO 500 LB.	LB.	132.0	$0.47	$61	Q-10	0.098	$251	$313
8	E-TSTAT1	SINGLE SETPOINT ELEC. TSTAT, 3 WIRE	EA.	1.0	$24.23	$24	1-ELEC	0.8	$17	$41
9	WIRE#12	COPPER WIRING #12	C.L.F.	0.5	$7.41	$4	1-ELEC	0.727	$8	$11
10	ACCU7.5	7.5 TON ACCU	EA.	1.0	$3,125.03	$3,125	Q-5	29.091	$564	$3,689
11	CUPIP2	COPPER PIPE TYPE L, 2" W/HANGERS	L.F.	15.0	$5.96	$89	1-PLUM	0.19	$61	$151
12		VALVES AND FITTINGS ADD 15%				$13			$9	$23
13	CUPIP0.75	COPPER PIPE TYPE L, 0.75" W/HANGERS	L.F.	15.0	$1.84	$28	1-PLUM	0.105	$34	$62
14		VALVES AND FITTINGS ADD 15%				$4			$5	$9
15	WIRE#6	COPPER WIRING #6	C.L.F.	1.0	$24.71	$25	1-ELEC	1.231	$26	$50
16										
17										
18										
19										
20										
21										
22										
23										
24										
25		*EXISTING SYSTEMS DEMOLITION*								
26		WAC REMOVAL	TON	0.8			Q-5	17.778	$259	$259
27										
28										
29										
30										
31		**SUBTOTAL**				$5,729			$1,549	$7,278
32	OH	OVERHEAD			17%	$962			$260	$1,223
33	PRO	PROFIT			10%	$669			$181	$850
34	CONT	CONTINGENCY			20%	$1,472			$398	$1,870
35	**TOTAL COST**		-	-	-	$8,833	-	-	$2,387	$11,220

ENGINEER'S OPINION OF PROBABLE COST

PROJECT	Fort Riley Feasibility Study for HVAC Upgrade	**SHEET**	1 OF 1
ENGINEER	E M C Engineers, Inc.	**DATE PREPARED**	4-May-95
	Denver, CO	**ESTIMATOR**	C. Wohlert
		CHECKED BY	A. Niemeyer

Line No.	Item Refer Code	Item Description	Unit of Measure	MATERIAL COST Quantity	MATERIAL COST Unit Cost	MATERIAL COST Total	LABOR COST Crew/ Worker	LABOR COST Hours/ Unit	LABOR COST Total	TOTAL
1		**BUILDING 7178**								
2		**NON-RECURRING**								
3										
4		*EXISTING SYSTEM REPLACEMENT*								
5	WAC1.5	WINDOW AIR CONDITIONER, 1.5 TON	EA.	3.0	$750.98	$2,253	L-2	2.667	$129	$2,382
6										
7										
8										
9										
10										
11										
12										
13										
14										
15										
16										
17										
18										
19										
20		*EXISTING SYSTEMS DEMOLITION*								
21		WAC REMOVAL	TON	0.8			Q-5	17.778	$259	$259
22										
23										
24										
25										
26										
27										
28										
29										
30										
31		**SUBTOTAL**				$2,253			$388	$2,641
32	OH	OVERHEAD			17%	$378			$65	$444
33	PRO	PROFIT			10%	$263			$45	$308
34	CONT	CONTINGENCY			20%	$579			$100	$679
35	**TOTAL COST**		-	-	-	$3,473	-	-	$598	$4,071

ENGINEER'S OPINION OF PROBABLE COST

PROJECT	Fort Riley Feasibility Study for HVAC Upgrade	SHEET 1 OF 1	
		DATE PREPARED	4-May-95
ENGINEER	E M C Engineers, Inc. Denver, CO	ESTIMATOR	C. Wohlert
		CHECKED BY	A. Niemeyer

Line No.	Item Refer Code	Item Description	Unit of Measure	MATERIAL COST Quantity	MATERIAL COST Unit Cost	MATERIAL COST Total	LABOR COST Crew/ Worker	LABOR COST Hours/ Unit	LABOR COST Total	TOTAL
1		**BUILDING 7178** BLDG 7178								
2		***ANNUAL RECURRING***								
3		***ANNUAL MAINTENANCE COST - BASELINE***								
4	MNT-FC	MAINT. ON FCs - INSPEC. / YR	EA.	3.0	$0.00	$0	Q-6	4	$241	$241
5										
6										
7										
8										
9										
10										
11										
12										
13										
14										
15	**TOTAL ANNUAL MAINTENANCE COST - BASELINE**		-	-	-	$0	-	-	$241	$241
16										
17		***ANNUAL MAINTENANCE COST - NEW HVAC REPLACEMENT***								
18	MNT-AHU1	MAINT. ON AHU - INSPEC. / YR <= 5000 CFM	EA.	1.0			Q-6	19	$382	$382
19										
20										
21										
22										
23										
24										
25										
26										
27										
28										
29	**TOTAL ANNUAL MAINTENANCE COST - BASELINE**		-	-	-	$0	-	-	$382	$382
30										
31										
32										
33										
34										
35	**TOTAL ANNUAL MAINTENANCE COST SAVINGS**		-	-	-	$0	-	-	($141)	($141)

DEMAND LIMITING ANALYSIS BUILDING 7178

	1993	1993	1993	1993	1993	1993	1993	1993	1993	1993	1993	1993
SUMMER PEAK (KW) =	JUL BILL	AUG BILL	SEP BILL	OCT BILL	NOV BILL	DEC BILL	JAN BILL	FEB BILL	MAR BILL	APR BILL	MAY BILL	JUN BILL
27812	7/1-8/2	8/2-9/1	9/3-10/1	10/1-11/1	11/1-12/1	12/1-1/3	1/4-2/1	2/1-3/1	3/3-4/1	4/1-5/3	5/3-6/1	6/1-7/1
	ACTUAL	ACTUAL	ACTUAL	ACTUAL	ACTUAL	ACTUAL	ACTUAL	ACTUAL	ACTUAL	ACTUAL	ACTUAL	ACTUAL
BASE CASE												
CAPACITY (KW)	32472	34452	26136	20754	26400	22752	27108	25812	23310	21834	21996	30096
POWER FACTOR (%)	99.20%	99.10%	99.10%	99.90%	99.80%	99.70%	99.50%	99.60%	99.60%	99.80%	99.60%	98.80%
CAPACITY (KVA)	32734	34765	26373	20775	26453	22820	27244	25916	23404	21878	22084	30462
80% SUMMER PEAK (KVA)	27812	27812	27812	27812	27812	27812	27812	27812	27812	27812	27812	27812
CONTRACT MINIMUM (KVA)	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643
BILLING CAPACITY (KVA)	32734	34765	27812	27812	27812	27812	27812	27812	27812	27812	27812	30462
ACTUAL OR 80% PEAK	ACTUAL	ACTUAL	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	ACTUAL
200 KVA @ $4.45	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00
NEXT 400 @ $4.25	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00
REMAINING @ $4.05	$130,142.18	$138,367.78	$110,208.22	$110,208.22	$110,208.22	$110,208.22	$110,208.22	$110,208.22	$110,208.22	$110,208.22	$110,208.22	$120,939.23
SUB DISCOUNT $.20	($6,546.77)	($6,952.98)	($5,562.38)	($5,562.38)	($5,562.38)	($5,562.38)	($5,562.38)	($5,562.38)	($5,562.38)	($5,562.38)	($5,562.38)	($6,092.31)
CAPACITY CHARGE	$126,185.40	$134,004.80	$107,235.84	$107,235.84	$107,235.84	$107,235.84	$107,235.84	$107,235.84	$107,235.84	$107,235.84	$107,235.84	$117,436.92
TOTAL ENERGY (KWH)	16,920,000	16,200,000	10,980,000	10,140,000	11,160,000	12,930,000	12,600,000	12,270,000	12,480,000	11,070,000	9,720,000	13,170,000
50*KVA @ $.03924	$64,223.85	$68,208.70	$54,566.96	$54,566.96	$54,566.96	$54,566.96	$54,566.96	$54,566.96	$54,566.96	$54,566.96	$54,566.96	$59,765.54
100*KVA @ $.03404	$111,426.10	$118,339.66	$94,671.73	$94,671.73	$94,671.73	$94,671.73	$94,671.73	$94,671.73	$94,671.73	$94,671.73	$94,671.73	$103,691.08
250*KVA @ $.03084	$252,378.15	$268,037.26	$209,965.32	$184,059.72	$214,429.80	$214,429.80	$214,429.80	$214,429.80	$214,429.80	$212,740.92	$171,106.92	$234,858.46
EXCESS @ $.02864	$109,589.57	$65,701.49	$0.00	$0.00	$1,009.19	$51,701.99	$42,250.79	$32,799.59	$38,813.99	$0.00	$0.00	$28,221.42
ENERGY CHARGE	$537,617.67	$520,287.11	$359,204.01	$333,298.41	$364,677.69	$415,370.49	$405,919.29	$396,468.09	$402,482.49	$361,979.61	$320,345.61	$426,536.49
TOTAL CHARGE LESS ECA	$663,803.07	$654,291.92	$466,439.85	$440,534.25	$471,913.53	$522,606.33	$513,155.13	$503,703.93	$509,718.33	$469,215.45	$427,581.45	$543,973.42
DEMAND REDUCTION (KW)	**13.53**	**15.94**	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**13.64**
CAPACITY (KW)	32458	34436	26136	20754	26400	22752	27108	25812	23310	21834	21996	30082
POWER FACTOR (%)	99.20%	99.10%	99.10%	99.90%	99.80%	99.70%	99.50%	99.60%	99.60%	99.80%	99.60%	98.80%
CAPACITY (KVA)	32720	34749	26373	20775	26453	22820	27244	25916	23404	21878	22084	30448
80% SUMMER PEAK (KVA)	27799	27799	27799	27799	27799	27799	27799	27799	27799	27799	27799	27799
CONTRACT MINIMUM (KVA)	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643
BILLING CAPACITY (KVA)	32720	34749	27799	27799	27799	27799	27799	27799	27799	27799	27799	30448
ACTUAL OR 80% PEAK	ACTUAL	ACTUAL	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	ACTUAL
200 KVA @ $4.45	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00
NEXT 400 @ $4.25	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00
REMAINING @ $4.05	$130,086.93	$138,302.65	$110,156.12	$110,156.12	$110,156.12	$110,156.12	$110,156.12	$110,156.12	$110,156.12	$110,156.12	$110,156.12	$120,883.33
SUB DISCOUNT $.20	($6,544.05)	($6,949.76)	($5,559.81)	($5,559.81)	($5,559.81)	($5,559.81)	($5,559.81)	($5,559.81)	($5,559.81)	($5,559.81)	($5,559.81)	($6,089.55)
CAPACITY CHARGE	$126,132.88	$133,942.89	$107,186.31	$107,186.31	$107,186.31	$107,186.31	$107,186.31	$107,186.31	$107,186.31	$107,186.31	$107,186.31	$117,383.79
TOTAL ENERGY (KWH)	16,920,000	16,200,000	10,980,000	10,140,000	11,160,000	12,930,000	12,600,000	12,270,000	12,480,000	11,070,000	9,720,000	13,170,000
50*KVA @ $.03924	$64,197.09	$68,177.15	$54,541.72	$54,541.72	$54,541.72	$54,541.72	$54,541.72	$54,541.72	$54,541.72	$54,541.72	$54,541.72	$59,738.46
100*KVA @ $.03404	$111,379.66	$118,284.93	$94,627.94	$94,627.94	$94,627.94	$94,627.94	$94,627.94	$94,627.94	$94,627.94	$94,627.94	$94,627.94	$103,644.10
250*KVA @ $.03084	$252,272.97	$267,913.27	$210,024.83	$184,119.23	$214,330.62	$214,330.62	$214,330.62	$214,330.62	$214,330.62	$212,800.43	$171,166.43	$234,752.05
EXCESS @ $.02864	$109,745.85	$65,885.71	$0.00	$0.00	$1,156.57	$51,849.37	$42,398.17	$32,946.97	$38,961.37	$0.00	$0.00	$28,379.53
ENERGY CHARGE	$537,595.57	$520,261.06	$359,194.49	$333,288.89	$364,656.85	$415,349.65	$405,898.45	$396,447.25	$402,461.65	$361,970.09	$320,336.09	$426,514.13
TOTAL CHARGE LESS ECA	$663,728.46	$654,203.95	$466,380.81	$440,475.21	$471,843.16	$522,535.96	$513,084.76	$503,633.56	$509,647.96	$469,156.41	$427,522.41	$543,897.92
SUMMARY												
MONTHLY DIFFERENCE	$74.62	$87.96	$59.05	$59.05	$70.37	$70.37	$70.37	$70.37	$70.37	$59.05	$59.05	$75.50
ANNUAL DIFFERENCE.............		**$826.12**										

BUILDING 7243
ANNUAL ENERGY SAVINGS SUMMARY

Item	Baseline	ECO	Annual Energy Savings	Adj. Annual Energy Savings*
Annual Electric (MBTU)	411.21	318.98	92.23	49.61
Annual Natural Gas (MBTU)			0.00	0.00
Electric Demand June (KW)	90.80	66.55	24.25	13.04
Electric Demand July (KW)	93.67	69.61	24.06	12.94
Electric Demand August (KW)	96.28	67.94	28.34	15.24

*Energy savings prorated on a square foot basis:

Baseline Model Bldg 8021 (sq.ft.)	22517.5
ECO Model Bldg 7243 (sq.ft.)	12112.5
Square Footage Adjustment Factor	0.538

LIFE CYCLE COST ANALYSIS SUMMARY
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

LOCATION:	Fort Riley	REGION: 2 (Kansas)		PROJECT NO:	1406-005
PROJECT TITLE:	Feasibility Study for HVAC Upgrade			FISCAL YEAR:	1995
ANALYSIS DATE:	05/04/95	ECONOMIC LIFE:	20	PREPARED BY:	C. Wohlert

1. INVESTMENT: **BLDG 7243 - Replace 15 Window ACs w/ 5 SZ AHUs**

A.	CONSTRUCTION COST	=	$39,099	
B.	SIOH COST	(5.5% of 1A) =	$2,150	
C.	DESIGN COST	(6.0% of 1A) =	$2,346	
D.	TOTAL COST	(1A +1B +1C) =	$43,596	
E.	SALVAGE VALUE OF EXISTING EQUIPMENT =		$0	
F.	PUBLIC UTILITY COMPANY REBATE =		$0	
G.	TOTAL INVESTMENT	(1D -1E -1F) =	------->	$43,596

2. ENERGY SAVINGS (+) OR COST (-):

DATE OF NISTR 85-3273-9 USED FOR DISCOUNT FACTORS: JAN '95

	ENERGY SOURCE	FUEL COST $/MBTU (1)	SAVINGS MBTU/YR (2)	ANNUAL $ SAVINGS (3)	DISCOUNT FACTOR (4)	DISCOUNTED SAVINGS (5)	
A.	ELECT.	$12.10	50	$600	15.88	$9,532	
B.	DIST	$0.00	0	$0	19.16	$0	
C.	NAT GAS	$4.12	0	$0	18.30	$0	
D.	COAL	$0.00	0	$0	16.62	$0	
E.	ELEC. DEMAND			$790	14.88	$11,758	
F.	TOTAL		50	$1,390		-------->	$21,291

3. NON-ENERGY SAVINGS (+) OR COST (-)

A. ANNUAL RECURRING (+/-)

1 ANNUAL MAINTENANCE	($704)	14.88	($10,471)
2	$0	14.88	$0
3	$0	14.88	$0
4 TOTAL ANNUAL DISC. SAVINGS (+) / COST	($704)		($10,471)

B. NON-RECURRING (+/-)

ITEM	SAVINGS (+) COST(-) (1)	YEAR OF OCCURRENCE (2)	DISCOUNT FACTOR (3) (TABLE A-2)	DISCOUNTED SAVINGS/COST (4)
a. BASELINE EQUIP. REPLCMNT.	$19,638	5	0.863	$16,948
b.				$0
c.				$0
d.				$0
e.				$0
f. TOTAL	$19,638			$16,948

C. TOTAL NON-ENERGY DISCOUNTED SAVINGS (+) OR COST (-) (3A4 + 3Bf4) = $6,477

4.	FIRST YEAR DOLLAR SAVINGS (+) / COSTS (-)	(2F3+3A4+(3Bf1/Economic Life))	$1,669
5.	SIMPLE PAYBACK (SPB) IN YEARS (MUST BE < 10 YEARS TO QUALIFY)	(1G/4) =	26.13
6.	TOTAL NET DISCOUNTED SAVINGS	(2F5 + 3C) =	$27,767
7.	DISCOUNTED SAVINGS-TO-INVESTMENT RATIO (SIR) (MUST HAVE SIR > 1.25 TO QUALIFY)	(6/1G) =	0.64

ENGINEER'S OPINION OF PROBABLE COST

PROJECT	Fort Riley Feasibility Study for HVAC Upgrade	**SHEET**	1 OF 1
ENGINEER	E M C Engineers, Inc.	**DATE PREPARED**	4-May-95
	Denver, CO	**ESTIMATOR**	C. Wohlert
		CHECKED BY	A. Niemeyer

Line No.	Item Refer Code	Item Description	Unit of Measure	MATERIAL COST Quantity	MATERIAL COST Unit Cost	MATERIAL COST Total	LABOR COST Crew/ Worker	LABOR COST Hours/ Unit	LABOR COST Total	TOTAL
1		**BUILDING 7243**								
2		**PROPOSED SYSTEM MODIFICATIONS**								
3										
4		*NEW SYSTEMS INSTALLATION*								
5	AHUH1300	1,300 CFM AHU	EA.	5.0	$2,296.53	$11,483	Q-5	13.9965	$1,357	$12,840
6	12X6SA	12X6 SA GRILLES	EA.	20.0	$9.84	$197	1-SHEE	0.348	$145	$342
7	DUCT500	GAL. STEEL DUCTWORK, 200 TO 500 LB.	LB.	470.0	$0.47	$219	Q-10	0.098	$895	$1,113
8	E-TSTAT1	SINGLE SETPOINT ELEC. TSTAT, 3 WIRE	EA.	5.0	$24.23	$121	1-ELEC	0.8	$84	$205
9	WIRE#12	COPPER WIRING #12	C.L.F.	2.5	$7.41	$19	1-ELEC	0.727	$38	$57
10	STLPIP1.5	STEEL PIPE SCH. 40, 1.5" W/HANGERS	L.F.	420.0	$2.95	$1,237	Q-1	0.2	$1,629	$2,866
11		VALVES AND FITTINGS ADD 15%				$186			$244	$430
12	INSLPIP1.25	1.25" FIBERGLASS PIPE INSULATION, 1.5" THCK	L.F.	210.0	$1.40	$293	Q-14	0.08	$309	$602
13	CNTVLV1.25	CONTROL VALVE 2-1/2"	EA.	5.0	$935.09	$4,675	1-PLUM	3.556	$383	$5,058
14										
15										
16										
17										
18										
19										
20										
21										
22										
23										
24										
25		*EXISTING SYSTEMS DEMOLITION*								
26		WAC REMOVAL	TON	1.9			Q-5	17.778	$655	$655
27		DUCT & EXHAUST FANS	TON	0.5			Q-5	17.778	$172	$172
28		ASBESTOS REMOVAL	GLV. BAG	6.0	$170.00	$1,020				$1,020
29										
30										
31		**SUBTOTAL**				$19,449			$5,911	$25,360
32	OH	OVERHEAD			17%	$3,267			$993	$4,260
33	PRO	PROFIT			10%	$2,272			$690	$2,962
34	CONT	CONTINGENCY			20%	$4,998			$1,519	$6,517
35	**TOTAL COST**		-	-	-	$29,985	-	-	$9,114	$39,099

ENGINEER'S OPINION OF PROBABLE COST

PROJECT	Fort Riley Feasibility Study for HVAC Upgrade	**SHEET** 1 **OF** 1	
ENGINEER	E M C Engineers, Inc.	**DATE PREPARED**	4-May-95
	Denver, CO	**ESTIMATOR**	C. Wohlert
		CHECKED BY	A. Niemeyer

Line No.	Item Refer Code	Item Description	Unit of Measure	MATERIAL COST Quantity	MATERIAL COST Unit Cost	MATERIAL COST Total	LABOR COST Crew/Worker	LABOR COST Hours/Unit	LABOR COST Total	TOTAL
1		**BUILDING 7243**								
2		**NON-RECURRING**								
3										
4		*EXISTING SYSTEM REPLACEMENT*								
5	WAC1.5	WINDOW AIR CONDITIONER, 1.5 TON	EA.	15.0	$750.98	$11,265	L-2	2.667	$645	$11,910
6										
7										
8										
9										
10										
11										
12										
13										
14										
15										
16										
17										
18										
19										
20		*EXISTING SYSTEMS DEMOLITION*								
21		WAC REMOVAL	TON	1.9			Q-5	17.778	$655	$655
22		DUCT & EXHAUST FANS	TON	0.5			Q-5	17.778	$172	$172
23										
24										
25										
26										
27										
28										
29										
30										
31		**SUBTOTAL**				$11,265			$1,473	$12,737
32	OH	OVERHEAD			17%	$1,892			$247	$2,140
33	PRO	PROFIT			10%	$1,316			$172	$1,488
34	CONT	CONTINGENCY			20%	$2,895			$378	$3,273
35	**TOTAL COST**		-	-	-	$17,367	-	-	$2,271	$19,638

ENGINEER'S OPINION OF PROBABLE COST

PROJECT	Fort Riley Feasibility Study for HVAC Upgrade	**SHEET**	1 **OF** 1
ENGINEER	E M C Engineers, Inc.	**DATE PREPARED**	4-May-95
	Denver, CO	**ESTIMATOR**	C. Wohlert
		CHECKED BY	A. Niemeyer

Line No.	Item Refer Code	Item Description	Unit of Measure	MATERIAL COST Quantity	MATERIAL COST Unit Cost	MATERIAL COST Total	LABOR COST Crew/ Worker	LABOR COST Hours/ Unit	LABOR COST Total	TOTAL
1		**BUILDING 7243**								
2		***ANNUAL RECURRING***								
3		***ANNUAL MAINTENANCE COST - BASELINE***								
4	MNT-FC	MAINT. ON FCs - INSPEC. / YR	EA.	15.0	$0.00	$0	Q-6	4	$1,206	$1,206
5										
6										
7										
8										
9										
10										
11										
12										
13										
14										
15	**TOTAL ANNUAL MAINTENANCE COST - BASELINE**		-	-	-	$0	-	-	$1,206	$1,206
16										
17		***ANNUAL MAINTENANCE COST - NEW HVAC REPLACEMENT***								
18	MNT-AHU1	MAINT. ON AHU - INSPEC. / YR <= 5000 CFM		5.0			Q-6	19	$1,910	$1,910
19										
20										
21										
22										
23										
24										
25										
26										
27										
28										
29	**TOTAL ANNUAL MAINTENANCE COST - BASELINE**		-	-	-	$0	-	-	$1,910	$1,910
30										
31										
32										
33										
34										
35	**TOTAL ANNUAL MAINTENANCE COST SAVINGS**		-	-	-	$0	-	-	($704)	($704)

DEMAND LIMITING ANALYSIS BUILDING 7243

SUMMER PEAK (KW) = 27812	1993 JUL BILL 7/1-8/2 ACTUAL	1993 AUG BILL 8/2-9/1 ACTUAL	1993 SEP BILL 9/3-10/1 ACTUAL	1993 OCT BILL 10/1-11/1 ACTUAL	1993 NOV BILL 11/1-12/1 ACTUAL	1993 DEC BILL 12/1-1/3 ACTUAL	1993 JAN BILL 1/4-2/1 ACTUAL	1993 FEB BILL 2/1-3/1 ACTUAL	1993 MAR BILL 3/3-4/1 ACTUAL	1993 APR BILL 4/1-5/3 ACTUAL	1993 MAY BILL 5/3-6/1 ACTUAL	1993 JUN BILL 6/1-7/1 ACTUAL
BASE CASE												
CAPACITY (KW)	32472	34452	26136	20754	26400	22752	27108	25812	23310	21834	21996	30096
POWER FACTOR (%)	99.20%	99.10%	99.10%	99.90%	99.80%	99.70%	99.50%	99.60%	99.60%	99.80%	99.60%	98.80%
CAPACITY (KVA)	32734	34765	26373	20775	26453	22820	27244	25916	23404	21878	22084	30462
80% SUMMER PEAK (KVA)	27812	27812	27812	27812	27812	27812	27812	27812	27812	27812	27812	27812
CONTRACT MINIMUM (KVA)	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643
BILLING CAPACITY (KVA)	32734	34765	27812	27812	27812	27812	27812	27812	27812	27812	27812	30462
ACTUAL OR 80% PEAK	ACTUAL	ACTUAL	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	ACTUAL
200 KVA @ $4.45	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00
NEXT 400 @ $4.25	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00
REMAINING @ $4.05	$130,142.18	$138,367.78	$110,208.22	$110,208.22	$110,208.22	$110,208.22	$110,208.22	$110,208.22	$110,208.22	$110,208.22	$110,208.22	$120,939.23
SUB DISCOUNT $.20	($6,546.77)	($6,952.98)	($5,562.38)	($5,562.38)	($5,562.38)	($5,562.38)	($5,562.38)	($5,562.38)	($5,562.38)	($5,562.38)	($5,562.38)	($6,092.31)
CAPACITY CHARGE	$126,185.40	$134,004.80	$107,235.84	$107,235.84	$107,235.84	$107,235.84	$107,235.84	$107,235.84	$107,235.84	$107,235.84	$107,235.84	$117,436.92
TOTAL ENERGY (KWH)	16,920,000	16,200,000	10,980,000	10,140,000	11,160,000	12,930,000	12,600,000	12,270,000	12,480,000	11,070,000	9,720,000	13,170,000
50*KVA @ $.03924	$64,223.85	$68,208.70	$54,566.96	$54,566.96	$54,566.96	$54,566.96	$54,566.96	$54,566.96	$54,566.96	$54,566.96	$54,566.96	$59,765.54
100*KVA @ $.03404	$111,426.10	$118,339.66	$94,671.73	$94,671.73	$94,671.73	$94,671.73	$94,671.73	$94,671.73	$94,671.73	$94,671.73	$94,671.73	$103,691.08
250*KVA @ $.03084	$252,378.15	$268,037.26	$209,965.32	$184,059.72	$214,429.80	$214,429.80	$214,429.80	$214,429.80	$214,429.80	$212,740.92	$171,106.92	$234,858.46
EXCESS @ $.02864	$109,589.57	$65,701.49	$0.00	$0.00	$1,009.19	$51,701.99	$42,250.79	$32,799.59	$38,813.99	$0.00	$0.00	$28,221.42
ENERGY CHARGE	$537,617.67	$520,287.11	$359,204.01	$333,298.41	$364,677.69	$415,370.49	$405,919.29	$396,468.09	$402,482.49	$361,979.61	$320,345.61	$426,536.49
TOTAL CHARGE LESS ECA	$663,803.07	$654,291.92	$466,439.85	$440,534.25	$471,913.53	$522,606.33	$513,155.13	$503,703.93	$509,718.33	$469,215.45	$427,581.45	$543,973.42
DEMAND REDUCTION (KW)	**12.94**	**15.24**	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**13.04**
CAPACITY (KW)	32459	34437	26136	20754	26400	22752	27108	25812	23310	21834	21996	30083
POWER FACTOR (%)	99.20%	99.10%	99.10%	99.90%	99.80%	99.70%	99.50%	99.60%	99.60%	99.80%	99.60%	98.80%
CAPACITY (KVA)	32721	34750	26373	20775	26453	22820	27244	25916	23404	21878	22084	30448
80% SUMMER PEAK (KVA)	27800	27800	27800	27800	27800	27800	27800	27800	27800	27800	27800	27800
CONTRACT MINIMUM (KVA)	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643
BILLING CAPACITY (KVA)	32721	34750	27800	27800	27800	27800	27800	27800	27800	27800	27800	30448
ACTUAL OR 80% PEAK	ACTUAL	ACTUAL	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	ACTUAL
200 KVA @ $4.45	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00
NEXT 400 @ $4.25	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00
REMAINING @ $4.05	$130,089.33	$138,305.48	$110,158.39	$110,158.39	$110,158.39	$110,158.39	$110,158.39	$110,158.39	$110,158.39	$110,158.39	$110,158.39	$120,885.76
SUB DISCOUNT $.20	($6,544.16)	($6,949.90)	($5,559.92)	($5,559.92)	($5,559.92)	($5,559.92)	($5,559.92)	($5,559.92)	($5,559.92)	($5,559.92)	($5,559.92)	($6,089.67)
CAPACITY CHARGE	$126,135.17	$133,945.58	$107,188.47	$107,188.47	$107,188.47	$107,188.47	$107,188.47	$107,188.47	$107,188.47	$107,188.47	$107,188.47	$117,386.10
TOTAL ENERGY (KWH)	16,920,000	16,200,000	10,980,000	10,140,000	11,160,000	12,930,000	12,600,000	12,270,000	12,480,000	11,070,000	9,720,000	13,170,000
50*KVA @ $.03924	$64,198.25	$68,178.52	$54,542.82	$54,542.82	$54,542.82	$54,542.82	$54,542.82	$54,542.82	$54,542.82	$54,542.82	$54,542.82	$59,739.64
100*KVA @ $.03404	$111,381.68	$118,287.31	$94,629.84	$94,629.84	$94,629.84	$94,629.84	$94,629.84	$94,629.84	$94,629.84	$94,629.84	$94,629.84	$103,646.14
250*KVA @ $.03084	$252,277.54	$267,918.66	$210,022.24	$184,116.64	$214,334.93	$214,334.93	$214,334.93	$214,334.93	$214,334.93	$212,797.84	$171,163.84	$234,756.67
EXCESS @ $.02864	$109,739.06	$65,877.70	$0.00	$0.00	$1,150.16	$51,842.96	$42,391.76	$32,940.56	$38,954.96	$0.00	$0.00	$28,372.66
ENERGY CHARGE	$537,596.53	$520,262.19	$359,194.91	$333,289.31	$364,657.75	$415,350.55	$405,899.35	$396,448.15	$402,462.55	$361,970.51	$320,336.51	$426,515.11
TOTAL CHARGE LESS ECA	$663,731.70	$654,207.78	$466,383.37	$440,477.77	$471,846.22	$522,539.02	$513,087.82	$503,636.62	$509,651.02	$469,158.97	$427,524.97	$543,901.20
SUMMARY												
MONTHLY DIFFERENCE	$71.37	$84.14	$56.48	$56.48	$67.31	$67.31	$67.31	$67.31	$67.31	$56.48	$56.48	$72.22
ANNUAL DIFFERENCE.............		**$790.21**										

NUMBER OF EXTERIOR SURFACES 27 RECTANGULAR 27 OTHER 0
(U-VALUE INCLUDES INSIDE AIR FILM PLUS OUTSIDE AIR FILM AT 7.5 MPH WINDSPEED)

SURFACE	SPACE	- - - - G L A S S - - - - U-VALUE (BTU/HR-SQFT-F)	AREA (SQFT)	- - - - W A L L - - - - U-VALUE (BTU/HR-SQFT-F)	AREA (SQFT)	- W A L L + G L A S S - U-VALUE (BTU/HR-SQFT-F)	AREA (SQFT)	AZIMUTH
	1ST_COMPNY	1.021	144.00	0.096	456.00	0.318	600.00	SOUTH-EAST
	2-COMPNY	1.021	144.00	0.096	456.00	0.318	600.00	SOUTH-EAST
	5TH_COMPNY	1.021	144.00	0.096	456.00	0.318	600.00	SOUTH-EAST
	3-COMPNY	1.021	144.00	0.096	456.00	0.318	600.00	SOUTH-EAST
	4-COMPNY	1.021	144.00	0.096	456.00	0.318	600.00	SOUTH-EAST
	5TH_COMPNY	0.000	0.00	0.096	420.00	0.096	420.00	SOUTH-WEST
	5EQUPMAIN	0.000	0.00	0.096	767.00	0.096	767.00	SOUTH-WEST
	1EQUPMAIN	0.000	0.00	0.096	650.00	0.096	650.00	NORTH-WEST
	2-EQUPMAN	0.000	0.00	0.096	650.00	0.096	650.00	NORTH-WEST
	3-EQUPMAN	0.000	0.00	0.096	650.00	0.096	650.00	NORTH-WEST
	5EQUPMAIN	0.000	0.00	0.096	650.00	0.096	650.00	NORTH-WEST
	4-EQUPMAN	0.000	0.00	0.096	650.00	0.096	650.00	NORTH-WEST
	5TH_COMPNY	0.000	0.00	0.020	1334.00	0.020	1334.00	ROOF
	5-VALT	0.000	0.00	0.020	340.00	0.020	340.00	ROOF
	2-COMPNY	0.000	0.00	0.020	1334.00	0.020	1334.00	ROOF
	2-VALT	0.000	0.00	0.020	340.00	0.020	340.00	ROOF
	5EQUPMAIN	0.000	0.00	0.127	2950.00	0.127	2950.00	ROOF
	1ST_COMPNY	0.000	0.00	0.020	1334.00	0.020	1334.00	ROOF
	3-COMPNY	0.000	0.00	0.020	1334.00	0.020	1334.00	ROOF
	3-VALT	0.000	0.00	0.020	340.00	0.020	340.00	ROOF
	2-EQUPMAN	0.000	0.00	0.127	2950.00	0.127	2950.00	ROOF
	3-EQUPMAN	0.000	0.00	0.127	2950.00	0.127	2950.00	ROOF

EMC ENGINEERS INC. EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/ 6/1995 16:10:11 LDL RUN 1
DENVER, CO 80227 EXISTING CONDITION OF BLDG. #7243 ADM. & SUPPLY BLDG
REPORT- LV-D DETAILS OF EXTERIOR SURFACES IN THE PROJECT TOPEKA, KS

	1EQUPMAIN	0.000	0.00	0.127	2950.00	0.127	2950.00	ROOF
	4-COMPNY	0.000	0.00	0.020	1334.00	0.020	1334.00	ROOF
	4-VALT	0.000	0.00	0.020	340.00	0.020	340.00	ROOF
	1ARMS-VALT	0.000	0.00	0.020	340.00	0.020	340.00	ROOF
	4-EQUPMAN	0.000	0.00	0.127	2950.00	0.127	2950.00	ROOF
	1ST_COMPNY	0.000	0.00	0.020	1334.00	0.020	1334.00	UNDERGRND
	1ARMS-VALT	0.000	0.00	0.020	340.00	0.020	340.00	UNDERGRND
	1EQUPMAIN	0.000	0.00	0.020	2950.00	0.020	2950.00	UNDERGRND
	2-COMPNY	0.000	0.00	0.020	1334.00	0.020	1334.00	UNDERGRND
	2-VALT	0.000	0.00	0.020	340.00	0.020	340.00	UNDERGRND
	2-EQUPMAN	0.000	0.00	0.020	2950.00	0.020	2950.00	UNDERGRND
	5TH_COMPNY	0.000	0.00	0.020	1334.00	0.020	1334.00	UNDERGRND
	5-VALT	0.000	0.00	0.020	340.00	0.020	340.00	UNDERGRND
	5EQUPMAIN	0.000	0.00	0.020	2950.00	0.020	2950.00	UNDERGRND
	3-COMPNY	0.000	0.00	0.020	1334.00	0.020	1334.00	UNDERGRND

3-VALT	0.000	0.00	0.020	340.00	0.020	340.00	UNDERGRND
3-EQUPMAN	0.000	0.00	0.020	2950.00	0.020	2950.00	UNDERGRND
4-COMPNY	0.000	0.00	0.020	1334.00	0.020	1334.00	UNDERGRND
4-VALT	0.000	0.00	0.020	340.00	0.020	340.00	UNDERGRND
4-EQUPMAN	0.000	0.00	0.020	2950.00	0.020	2950.00	UNDERGRND

	AVERAGE U-VALUE/GLASS (BTU/HR-SQFT-F)	AVERAGE U-VALUE/WALLS (BTU/HR-SQFT-F)	AVERAGE U-VALUE WALLS+GLASS (BTU/HR-SQFT-F)	GLASS AREA (SQFT)	OPAQUE AREA (SQFT)	GLASS+OPAQUE AREA (SQFT)
SOUTH-EAST	1.021	0.096	0.318	720.00	2280.00	3000.00
SOUTH-WEST	0.000	0.096	0.096	0.00	1187.00	1187.00
NORTH-WEST	0.000	0.096	0.096	0.00	3250.00	3250.00
ROOF	0.000	0.088	0.088	0.00	23120.00	23120.00
ALL WALLS	1.021	0.096	0.186	720.00	6717.00	7437.00
WALLS+ROOFS	1.021	0.090	0.112	720.00	29837.00	30557.00
UNDERGRND	0.000	0.020	0.020	0.00	23120.00	23120.00
BUILDING	1.021	0.059	0.072	720.00	52957.00	53677.00

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  EMC      ENGINEERS      INC.       EZDOE - ELITE SOFTWARE DEVELOPMENT INC      DOE-2.1D   2/ 6/1995    16:10:11  LDL RUN 1
  DENVER,       CO       80227       EXISTING CONDITION OF BLDG. #7243       ADM. & SUPPLY BLDG
REPORT- LS-C BUILDING PEAK LOAD COMPONENTS                                          TOPEKA, KS
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*** BUILDING ***

                FLOOR  AREA     20818  SQFT      1934  SQMT
                VOLUME         263970  CUFT      7476  CUMT

                                  COOLING  LOAD                               HEATING  LOAD
                               ====================                       ====================
             TIME                 AUG 11  4PM                                SEP 18  2AM
             DRY-BULB TEMP         100F     38C                                50F     10C
             WET-BULB TEMP          71F     22C                                48F      9C

                              SENSIBLE             LATENT                      SENSIBLE
                         (KBTU/H)   ( KW )   (KBTU/H)  ( KW )             (KBTU/H)   ( KW )
                         --------   ------   --------  ------             --------  --------
    WALLS                  17.321    5.073     0.000    0.000              -14.824    -4.342
    ROOFS                  76.283   22.341     0.000    0.000              -46.805   -13.708
    GLASS CONDUCTION       14.119    4.135     0.000    0.000              -19.288    -5.649
    GLASS SOLAR            53.275   15.603     0.000    0.000                3.342     0.979
    DOOR                    0.000    0.000     0.000    0.000                0.000     0.000
    INTERNAL SURFACES      -5.695   -1.668     0.000    0.000               -5.695    -1.668
    UNDERGROUND SURFACES   -2.027   -0.594     0.000    0.000               -1.872    -0.548
    OCCUPANTS TO SPACE     41.902   12.272    65.945   19.314                0.114     0.034
    LIGHT     TO SPACE    102.646   30.062     0.000    0.000                0.431     0.126
    EQUIPMENT TO SPACE     13.487    3.950     0.000    0.000                0.037     0.011
    PROCESS   TO SPACE      0.000    0.000     0.000    0.000                0.000     0.000
    INFILTRATION           35.761   10.473     4.909    1.438              -58.337   -17.086
                         --------  -------   -------   ------             --------  --------
    TOTAL                 347.073  101.649    70.854   20.751             -142.897   -41.851
    TOTAL LOAD            417.927 KBTU/H     122.400   KW          -142.897 KBTU/H   -41.851  KW
    TOTAL LOAD / AREA       20.08BTU/H.SQFT   63.288    W /SQMT      6.864BTU/H.SQFT  21.640    W /SQMT

                  ***************************************************************
                  *                                                             *
                  *  NOTE  1)THE ABOVE LOADS EXCLUDE OUTSIDE VENTILATION AIR    *
                  *  ----     LOADS                                             *
                  *        2)TIMES GIVEN IN STANDARD TIME FOR THE LOCATION      *
                  *           IN CONSIDERATION                                  *
                  *                                                             *
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EMC ENGINEERS INC. EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/ 6/1995 16:10:11 SDL RUN 1
DENVER, CO 80227 EXISTING CONDITION OF BLDG. #7243 ADM. & SUPPLY BLDG
REPORT- SS-A SYSTEM MONTHLY LOADS SUMMARY FOR WINDOW_AC1 TOPEKA, KS

	COOLING						HEATING						ELEC	
MONTH	COOLING ENERGY (MBTU)	TIME OF MAX DY	HR	DRY-BULB TEMP	WET-BULB TEMP	MAXIMUM COOLING LOAD (KBTU/HR)	HEATING ENERGY (MBTU)	TIME OF MAX DY	HR	DRY-BULB TEMP	WET-BULB TEMP	MAXIMUM HEATING LOAD (KBTU/HR)	ELEC-TRICAL ENERGY (KWH)	MAXIMUM ELEC LOAD (KW)
MAY	4.12308	31	12	84.F	74.F	40.296	-0.007	15	6	60.F	60.F	-2.382	1262.	11.867
JUN	10.72405	24	13	86.F	76.F	42.841	0.000					0.000	2998.	12.442
JUL	12.80529	1	16	86.F	80.F	47.704	0.000					0.000	3342.	13.015
AUG	14.36382	24	16	96.F	77.F	45.394	0.000					0.000	3858.	13.507
SEP	8.45416	6	16	93.F	76.F	45.872	0.000					0.000	2505.	13.263
OCT	0.06436	1	16	83.F	67.F	17.727	0.000					0.000	16.	3.998
TOTAL	50.535						-0.007						13981.	
MAX						47.704						-2.382		13.507

EMC ENGINEERS INC. EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/ 6/1995 16:10:11 SDL RUN 1
DENVER, CO 80227 EXISTING CONDITION OF BLDG. #7243 ADM. & SUPPLY BLDG
REPORT- SS-C SYSTEM MONTHLY LOAD HOURS FOR WINDOW_AC1 TOPEKA, KS

	NUMBER OF HOURS										COINCIDENT LOADS	
MONTH	HOURS COOLING LOAD	HOURS HEATING LOAD	HOURS COINCIDENT COOL-HEAT LOAD	HOURS FLOATING	HOURS HEATING AVAIL.	HOURS COOLING AVAIL.	HOURS FANS ON	HOURS FANS CYCLE ON	HOURS NIGHT VENTING	HOURS FLOATING WHEN FANS ON	HEATING LOAD AT COOLING PEAK (KBTU/HR)	ELECTRIC LOAD AT COOLING PEAK (KW)
MAY	199	4	0	205	24	408	199	199	0	0	0.000	11.622
JUN	430	0	0	290	0	720	430	430	0	0	0.000	12.182
JUL	478	0	0	266	0	744	478	478	0	0	0.000	12.844
AUG	522	0	0	222	0	744	522	522	0	0	0.000	13.507
SEP	350	0	0	370	0	720	413	413	0	63	0.000	13.263
OCT	5	0	0	19	0	24	15	15	0	10	0.000	3.998
ANNUAL	1984	4	0	1372	24	3360	2057	2057	0	73		

EMC ENGINEERS INC. EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/ 6/1995 16:10:11 SDL RUN 1
DENVER, CO 80227 EXISTING CONDITION OF BLDG. #7243 ADM. & SUPPLY BLDG
REPORT- SS-A SYSTEM MONTHLY LOADS SUMMARY FOR WINDOW_AC2 TOPEKA, KS

	COOLING						HEATING						ELEC	
MONTH	COOLING ENERGY (MBTU)	TIME OF MAX DY	HR	DRY-BULB TEMP	WET-BULB TEMP	MAXIMUM COOLING LOAD (KBTU/HR)	HEATING ENERGY (MBTU)	TIME OF MAX DY	HR	DRY-BULB TEMP	WET-BULB TEMP	MAXIMUM HEATING LOAD (KBTU/HR)	ELEC-TRICAL ENERGY (KWH)	MAXIMUM ELEC LOAD (KW)
MAY	4.15058	31	12	84.F	74.F	40.265	-0.007	15	6	60.F	60.F	-2.439	1267.	11.862
JUN	10.92451	20	13	86.F	76.F	42.871	0.000					0.000	3036.	12.444
JUL	13.10437	1	16	86.F	80.F	47.838	0.000					0.000	3396.	13.028
AUG	14.64564	24	16	96.F	77.F	45.646	0.000					0.000	3909.	13.548
SEP	8.55941	6	16	93.F	76.F	45.853	0.000					0.000	2525.	13.260
OCT	0.06313	1	16	83.F	67.F	17.480	0.000					0.000	16.	3.956
TOTAL	51.448						-0.007						14150.	
MAX						47.838						-2.439		13.548

EMC ENGINEERS INC. EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/ 6/1995 16:10:11 SDL RUN 1
DENVER, CO 80227 EXISTING CONDITION OF BLDG. #7243 ADM. & SUPPLY BLDG
REPORT- SS-C SYSTEM MONTHLY LOAD HOURS FOR WINDOW_AC2 TOPEKA, KS

	NUMBER OF HOURS										COINCIDENT LOADS	
MONTH	HOURS COOLING LOAD	HOURS HEATING LOAD	HOURS COINCIDENT COOL-HEAT LOAD	HOURS FLOATING	HOURS HEATING AVAIL.	HOURS COOLING AVAIL.	HOURS FANS ON	HOURS FANS CYCLE ON	HOURS NIGHT VENTING	HOURS FLOATING WHEN FANS ON	HEATING LOAD AT COOLING PEAK (KBTU/HR)	ELECTRIC LOAD AT COOLING PEAK (KW)
MAY	200	4	0	204	24	408	200	200	0	0	0.000	11.617
JUN	436	0	0	284	0	720	436	436	0	0	0.000	12.182
JUL	485	0	0	259	0	744	485	485	0	0	0.000	12.863
AUG	529	0	0	215	0	744	529	529	0	0	0.000	13.548
SEP	355	0	0	365	0	720	418	418	0	63	0.000	13.260
OCT	5	0	0	19	0	24	15	15	0	10	0.000	3.956
ANNUAL	2010	4	0	1346	24	3360	2083	2083	0	73		

EMC ENGINEERS INC. EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/ 6/1995 16:10:11 SDL RUN 1
DENVER, CO 80227 EXISTING CONDITION OF BLDG. #7243 ADM. & SUPPLY BLDG
REPORT- SS-A SYSTEM MONTHLY LOADS SUMMARY FOR H&V TOPEKA, KS

	COOLING					HEATING					ELEC	
MONTH	COOLING ENERGY (MBTU)	TIME OF MAX DY HR	DRY-BULB TEMP	WET-BULB TEMP	MAXIMUM COOLING LOAD (KBTU/HR)	HEATING ENERGY (MBTU)	TIME OF MAX DY HR	DRY-BULB TEMP	WET-BULB TEMP	MAXIMUM HEATING LOAD (KBTU/HR)	ELEC-TRICAL ENERGY (KWH)	MAXIMUM ELEC LOAD (KW)
MAY	0.00000				0.000	-0.015	15 23	66.F	63.F	-1.754	5930.	28.552
JUN	0.00000				0.000	0.000				0.000	10961.	28.552
JUL	0.00000				0.000	0.000				0.000	10802.	28.552
AUG	0.00000				0.000	0.000				0.000	11378.	28.552
SEP	0.00000				0.000	0.000				0.000	10770.	28.552
OCT	0.00000				0.000	0.000				0.000	225.	9.360
TOTAL	0.000					-0.015					50065.	
MAX					0.000					-1.754		28.552

EMC ENGINEERS INC. EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/ 6/1995 16:10:11 SDL RUN 1
DENVER, CO 80227 EXISTING CONDITION OF BLDG. #7243 ADM. & SUPPLY BLDG
REPORT- SS-C SYSTEM MONTHLY LOAD HOURS FOR H&V TOPEKA, KS

	NUMBER OF HOURS										COINCIDENT LOADS	
MONTH	HOURS COOLING LOAD	HOURS HEATING LOAD	HOURS COINCIDENT COOL-HEAT LOAD	HOURS FLOATING	HOURS HEATING AVAIL.	HOURS COOLING AVAIL.	HOURS FANS ON	HOURS FANS CYCLE ON	HOURS NIGHT VENTING	HOURS FLOATING WHEN FANS ON	HEATING LOAD AT COOLING PEAK (KBTU/HR)	ELECTRIC LOAD AT COOLING PEAK (KW)
MAY	0	12	0	396	24	0	408	0	0	396	0.000	9.360
JUN	0	0	0	720	0	0	720	0	0	720	0.000	9.360
JUL	0	0	0	744	0	0	744	0	0	744	0.000	9.360
AUG	0	0	0	744	0	0	744	0	0	744	0.000	9.360
SEP	0	0	0	720	0	0	720	0	0	720	0.000	9.360
OCT	0	0	0	24	0	0	24	0	0	24	0.000	9.360
ANNUAL	0	12	0	3348	24	0	3360	0	0	3348		

EMC ENGINEERS INC. EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/ 6/1995 16:10:11 SDL RUN 1
DENVER, CO 80227 EXISTING CONDITION OF BLDG. #7243 ADM. & SUPPLY BLDG
REPORT- SS-A SYSTEM MONTHLY LOADS SUMMARY FOR WINDOW_AC3 TOPEKA, KS

	COOLING						HEATING						ELEC	
MONTH	COOLING ENERGY (MBTU)	TIME OF MAX DY	HR	DRY-BULB TEMP	WET-BULB TEMP	MAXIMUM COOLING LOAD (KBTU/HR)	HEATING ENERGY (MBTU)	TIME OF MAX DY	HR	DRY-BULB TEMP	WET-BULB TEMP	MAXIMUM HEATING LOAD (KBTU/HR)	ELEC-TRICAL ENERGY (KWH)	MAXIMUM ELEC LOAD (KW)
MAY	4.06792	31	12	84.F	74.F	40.320	-0.012	15	6	60.F	60.F	-2.986	1251.	11.879
JUN	10.89381	20	13	86.F	76.F	42.887	0.000					0.000	3032.	12.426
JUL	13.14686	1	16	86.F	80.F	47.821	0.000					0.000	3405.	13.032
AUG	14.68221	24	16	96.F	77.F	45.736	0.000					0.000	3917.	13.563
SEP	8.45038	6	16	93.F	76.F	46.004	0.000					0.000	2504.	13.284
OCT	0.05428	1	16	83.F	67.F	16.653	0.000					0.000	13.	3.817
TOTAL	51.295						-0.012						14122.	
MAX						47.821						-2.986		13.563

EMC ENGINEERS INC. EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/ 6/1995 16:10:11 SDL RUN 1
DENVER, CO 80227 EXISTING CONDITION OF BLDG. #7243 ADM. & SUPPLY BLDG
REPORT- SS-C SYSTEM MONTHLY LOAD HOURS FOR WINDOW_AC3 TOPEKA, KS

	NUMBER OF HOURS										COINCIDENT LOADS	
MONTH	HOURS COOLING LOAD	HOURS HEATING LOAD	HOURS COINCIDENT COOL-HEAT LOAD	HOURS FLOATING	HOURS HEATING AVAIL.	HOURS COOLING AVAIL.	HOURS FANS ON	HOURS FANS CYCLE ON	HOURS NIGHT VENTING	HOURS FLOATING WHEN FANS ON	HEATING LOAD AT COOLING PEAK (KBTU/HR)	ELECTRIC LOAD AT COOLING PEAK (KW)
MAY	195	6	0	207	24	408	195	195	0	0	0.000	11.626
JUN	435	0	0	285	0	720	435	435	0	0	0.000	12.185
JUL	486	0	0	258	0	744	486	486	0	0	0.000	12.861
AUG	529	0	0	215	0	744	529	529	0	0	0.000	13.563
SEP	348	0	0	372	0	720	419	419	0	71	0.000	13.284
OCT	4	0	0	20	0	24	15	15	0	11	0.000	3.817
ANNUAL	1997	6	0	1357	24	3360	2079	2079	0	82		

EMC ENGINEERS INC. EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/ 6/1995 16:10:11 SDL RUN 1
DENVER, CO 80227 EXISTING CONDITION OF BLDG. #7243 ADM. & SUPPLY BLDG
REPORT- SS-A SYSTEM MONTHLY LOADS SUMMARY FOR WINDOW_AC4 TOPEKA, KS

	COOLING						HEATING						ELEC	
MONTH	COOLING ENERGY (MBTU)	TIME OF MAX DY	HR	DRY-BULB TEMP	WET-BULB TEMP	MAXIMUM COOLING LOAD (KBTU/HR)	HEATING ENERGY (MBTU)	TIME OF MAX DY	HR	DRY-BULB TEMP	WET-BULB TEMP	MAXIMUM HEATING LOAD (KBTU/HR)	ELEC-TRICAL ENERGY (KWH)	MAXIMUM ELEC LOAD (KW)
MAY	4.12948	31	12	84.F	74.F	40.282	-0.007	15	6	60.F	60.F	-2.410	1263.	11.865
JUN	10.82641	20	13	86.F	76.F	42.833	0.000					0.000	3018.	12.448
JUL	12.90734	1	16	86.F	80.F	47.752	0.000					0.000	3360.	13.022
AUG	14.49736	24	16	96.F	77.F	45.557	0.000					0.000	3883.	13.534
SEP	8.51880	6	16	93.F	76.F	45.911	0.000					0.000	2518.	13.269
OCT	0.06434	1	16	83.F	67.F	17.742	0.000					0.000	16.	4.000
TOTAL	50.944						-0.007						14058.	
MAX						47.752						-2.410		13.534

EMC ENGINEERS INC. EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/ 6/1995 16:10:11 SDL RUN 1
DENVER, CO 80227 EXISTING CONDITION OF BLDG. #7243 ADM. & SUPPLY BLDG
REPORT- SS-C SYSTEM MONTHLY LOAD HOURS FOR WINDOW_AC4 TOPEKA, KS

	NUMBER OF HOURS										COINCIDENT LOADS	
MONTH	HOURS COOLING LOAD	HOURS HEATING LOAD	HOURS COINCIDENT COOL-HEAT LOAD	HOURS FLOATING	HOURS HEATING AVAIL.	HOURS COOLING AVAIL.	HOURS FANS ON	HOURS FANS CYCLE ON	HOURS NIGHT VENTING	HOURS FLOATING WHEN FANS ON	HEATING LOAD AT COOLING PEAK (KBTU/HR)	ELECTRIC LOAD AT COOLING PEAK (KW)
MAY	199	4	0	205	24	408	199	199	0	0	0.000	11.620
JUN	434	0	0	286	0	720	434	434	0	0	0.000	12.177
JUL	480	0	0	264	0	744	480	480	0	0	0.000	12.851
AUG	526	0	0	218	0	744	526	526	0	0	0.000	13.534
SEP	353	0	0	367	0	720	416	416	0	63	0.000	13.269
OCT	5	0	0	19	0	24	15	15	0	10	0.000	4.000
ANNUAL	1997	4	0	1359	24	3360	2070	2070	0	73		

EMC ENGINEERS INC. EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/ 6/1995 16:10:11 SDL RUN 1
DENVER, CO 80227 EXISTING CONDITION OF BLDG. #7243 ADM. & SUPPLY BLDG
REPORT- SS-A SYSTEM MONTHLY LOADS SUMMARY FOR WINDOW_AC5 TOPEKA, KS

MONTH	COOLING: COOLING ENERGY (MBTU)	COOLING: TIME OF MAX DY	COOLING: TIME OF MAX HR	COOLING: DRY-BULB TEMP	COOLING: WET-BULB TEMP	COOLING: MAXIMUM COOLING LOAD (KBTU/HR)	HEATING: HEATING ENERGY (MBTU)	HEATING: TIME OF MAX DY	HEATING: TIME OF MAX HR	HEATING: DRY-BULB TEMP	HEATING: WET-BULB TEMP	HEATING: MAXIMUM HEATING LOAD (KBTU/HR)	ELEC: ELECTRICAL ENERGY (KWH)	ELEC: MAXIMUM ELEC LOAD (KW)
MAY	4.12934	31	12	84.F	74.F	40.283	-0.007	15	6	60.F	60.F	-2.414	1263.	11.865
JUN	10.82234	20	13	86.F	76.F	42.832	0.000					0.000	3017.	12.448
JUL	12.90737	1	16	86.F	80.F	47.752	0.000					0.000	3360.	13.022
AUG	14.49717	24	16	96.F	77.F	45.558	0.000					0.000	3883.	13.534
SEP	8.51539	6	16	93.F	76.F	45.912	0.000					0.000	2516.	13.269
OCT	0.06433	1	16	83.F	67.F	17.742	0.000					0.000	16.	4.000
TOTAL	50.936						-0.007						14055.	
MAX						47.752						-2.414		13.534

EMC ENGINEERS INC. EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/ 6/1995 16:10:11 SDL RUN 1
DENVER, CO 80227 EXISTING CONDITION OF BLDG. #7243 ADM. & SUPPLY BLDG
REPORT- SS-C SYSTEM MONTHLY LOAD HOURS FOR WINDOW_AC5 TOPEKA, KS

D2-16

MONTH	HOURS COOLING LOAD	HOURS HEATING LOAD	HOURS COINCIDENT COOL-HEAT LOAD	HOURS FLOATING	HOURS HEATING AVAIL.	HOURS COOLING AVAIL.	HOURS FANS ON	HOURS FANS CYCLE ON	HOURS NIGHT VENTING	HOURS FLOATING WHEN FANS ON	COINCIDENT LOADS: HEATING LOAD AT COOLING PEAK (KBTU/HR)	COINCIDENT LOADS: ELECTRIC LOAD AT COOLING PEAK (KW)
MAY	199	4	0	205	24	408	199	199	0	0	0.000	11.620
JUN	433	0	0	287	0	720	433	433	0	0	0.000	12.177
JUL	480	0	0	264	0	744	480	480	0	0	0.000	12.851
AUG	526	0	0	218	0	744	526	526	0	0	0.000	13.534
SEP	352	0	0	368	0	720	415	415	0	63	0.000	13.269
OCT	5	0	0	19	0	24	15	15	0	10	0.000	4.000
ANNUAL	1995	4	0	1361	24	3360	2068	2068	0	73		

EMC ENGINEERS INC. EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/ 6/1995 16:10:11 PDL RUN 1
DENVER, CO 80227 EXISTING CONDITION OF BLDG. #7243 ADM. & SUPPLY BLDG
REPORT- PS-B MONTHLY PEAK AND TOTAL ENERGY USE TOPEKA, KS

MO	UTILITY-	ELECTRICITY	NATURAL-GAS
	TOTAL(MBTU)	41.786	0.077
MAY	PEAK(KBTU)	300.097	17.606
	DY/HR	31/16	15/ 5
	TOTAL(MBTU)	88.991	0.000
JUN	PEAK(KBTU)	309.888	0.000
	DY/HR	28/16	30/ 1
	TOTAL(MBTU)	94.464	0.000
JUL	PEAK(KBTU)	319.705	0.000
	DY/HR	13/13	31/ 1
	TOTAL(MBTU)	105.260	0.000
AUG	PEAK(KBTU)	328.598	0.000
	DY/HR	24/16	31/ 1
	TOTAL(MBTU)	79.684	0.000
SEP	PEAK(KBTU)	324.019	0.000
	DY/HR	6/16	30/ 1
	TOTAL(MBTU)	1.027	0.000
OCT	PEAK(KBTU)	99.463	0.000
	DY/HR	1/16	1/ 1
	ONE YEAR	411.213	0.077
	USE/PEAK	328.598	17.606

EMC ENGINEERS INC. EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/ 6/1995 16:10:11 PDL RUN 1
DENVER, CO 80227 EXISTING CONDITION OF BLDG. #7243 ADM. & SUPPLY BLDG
REPORT- BEPS ESTIMATED BUILDING ENERGY PERFORMANCE TOPEKA, KS

ENERGY TYPE IN SITE MBTU - CATEGORY OF USE	ELECTRICITY	NATURAL-GAS
SPACE HEAT	0.00	0.08
SPACE COOL	175.40	0.00
HVAC AUX	108.52	0.00
DOM HOT WTR	0.00	0.00
AUX SOLAR	0.00	0.00
LIGHTS	113.06	0.00
VERT TRANS	0.00	0.00
MISC EQUIP	14.24	0.00
TOTAL	411.21	0.08

TOTAL SITE ENERGY 411.29 MBTU 17.5 KBTU/SQFT-YR GROSS-AREA 19.8 KBTU/SQFT-YR NET-AREA
TOTAL SOURCE ENERGY 1234.95 MBTU 52.6 KBTU/SQFT-YR GROSS-AREA 59.3 KBTU/SQFT-YR NET-AREA
PERCENT OF HOURS ANY SYSTEM ZONE OUTSIDE OF THROTTLING RANGE = 24.3
PERCENT OF HOURS ANY PLANT LOAD NOT SATISFIED = 0.0
NOTE ELECTRICITY AND/OR FUEL USED TO GENERATE ELECTRICITY IS APPORTIONED BASED ON THE YEARLY DEMAND. ALL OTHER ENERGY TYPES ARE APPORTIONED HOURLY.

EMC ENGINEERS INC. EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/ 6/1995 16:41:21 SDL RUN 1
DENVER, CO 80227 PROPOSED MODIFICATION OF BLDG. #7243 ADM. & SUPPLY BLDG
REPORT- SS-A SYSTEM MONTHLY LOADS SUMMARY FOR SMALL_SZ#1 TOPEKA, KS

	COOLING						HEATING						ELEC	
MONTH	COOLING ENERGY (MBTU)	TIME OF MAX DY	HR	DRY-BULB TEMP	WET-BULB TEMP	MAXIMUM COOLING LOAD (KBTU/HR)	HEATING ENERGY (MBTU)	TIME OF MAX DY	HR	DRY-BULB TEMP	WET-BULB TEMP	MAXIMUM HEATING LOAD (KBTU/HR)	ELEC-TRICAL ENERGY (KWH)	MAXIMUM ELEC LOAD (KW)
MAY	3.57519	31	12	84.F	74.F	46.374	-0.001	15	23	66.F	63.F	-0.384	436.	3.913
JUN	10.25514	20	13	86.F	76.F	47.291	0.000					0.000	873.	3.913
JUL	12.62197	1	16	86.F	80.F	53.889	0.000					0.000	798.	3.913
AUG	14.04644	23	15	95.F	77.F	50.164	0.000					0.000	916.	3.913
SEP	7.75637	6	16	93.F	76.F	50.324	0.000					0.000	833.	3.913
OCT	0.04601	1	18	83.F	68.F	14.649	0.000					0.000	1.	0.065
TOTAL	48.301						-0.001						3857.	
MAX						53.889						-0.384		3.913

EMC ENGINEERS INC. EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/ 6/1995 16:41:21 SDL RUN 1
DENVER, CO 80227 PROPOSED MODIFICATION OF BLDG. #7243 ADM. & SUPPLY BLDG
REPORT- SS-C SYSTEM MONTHLY LOAD HOURS FOR SMALL_SZ#1 TOPEKA, KS

	NUMBER OF HOURS										COINCIDENT LOADS	
MONTH	HOURS COOLING LOAD	HOURS HEATING LOAD	HOURS COINCIDENT COOL-HEAT LOAD	HOURS FLOATING	HOURS HEATING AVAIL.	HOURS COOLING AVAIL.	HOURS FANS ON	HOURS FANS CYCLE ON	HOURS NIGHT VENTING	HOURS FLOATING WHEN FANS ON	HEATING LOAD AT COOLING PEAK (KBTU/HR)	ELECTRIC LOAD AT COOLING PEAK (KW)
MAY	180	5	0	223	24	384	191	191	0	6	0.000	3.913
JUN	402	0	0	318	0	720	402	402	0	0	0.000	3.913
JUL	441	0	0	303	0	744	441	441	0	0	0.000	3.913
AUG	482	0	0	262	0	744	482	482	0	0	0.000	3.913
SEP	325	0	0	395	0	655	390	390	0	65	0.000	3.913
OCT	4	0	0	20	0	13	15	15	0	11	0.000	0.065
ANNUAL	1834	5	0	1521	24	3260	1921	1921	0	82		

EMC ENGINEERS INC. EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/ 6/1995 16:41:21 SDL RUN 1
DENVER, CO 80227 PROPOSED MODIFICATION OF BLDG. #7243 ADM. & SUPPLY BLDG
REPORT- SS-A SYSTEM MONTHLY LOADS SUMMARY FOR SMALL_SZ#2 TOPEKA, KS

	C O O L I N G						H E A T I N G						E L E C	
MONTH	COOLING ENERGY (MBTU)	TIME OF MAX DY	HR	DRY-BULB TEMP	WET-BULB TEMP	MAXIMUM COOLING LOAD (KBTU/HR)	HEATING ENERGY (MBTU)	TIME OF MAX DY	HR	DRY-BULB TEMP	WET-BULB TEMP	MAXIMUM HEATING LOAD (KBTU/HR)	ELEC-TRICAL ENERGY (KWH)	MAXIMUM ELEC LOAD (KW)
MAY	3.59990	31	12	84.F	74.F	46.284	-0.001	15	23	66.F	63.F	-0.371	436.	3.913
JUN	10.45370	20	13	86.F	76.F	47.306	0.000					0.000	873.	3.913
JUL	13.00339	1	16	86.F	80.F	54.059	0.000					0.000	799.	3.913
AUG	14.39960	24	16	96.F	77.F	50.184	0.000					0.000	917.	3.913
SEP	7.84052	6	16	93.F	76.F	50.300	0.000					0.000	833.	3.913
OCT	0.04523	1	18	83.F	68.F	14.416	0.000					0.000	1.	0.065
TOTAL	49.342						-0.001						3858.	
MAX						54.059						-0.371		3.913

EMC ENGINEERS INC. EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/ 6/1995 16:41:21 SDL RUN 1
DENVER, CO 80227 PROPOSED MODIFICATION OF BLDG. #7243 ADM. & SUPPLY BLDG
REPORT- SS-C SYSTEM MONTHLY LOAD HOURS FOR SMALL_SZ#2 TOPEKA, KS

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	N U M B E R O F H O U R S										--COINCIDENT LOADS--	
MONTH	HOURS COOLING LOAD	HOURS HEATING LOAD	HOURS COINCIDENT COOL-HEAT LOAD	HOURS FLOATING	HOURS HEATING AVAIL.	HOURS COOLING AVAIL.	HOURS FANS ON	HOURS FANS CYCLE ON	HOURS NIGHT VENTING	HOURS FLOATING WHEN FANS ON	HEATING LOAD AT COOLING PEAK (KBTU/HR)	ELECTRIC LOAD AT COOLING PEAK (KW)
MAY	181	5	0	222	24	384	192	192	0	6	0.000	3.913
JUN	404	0	0	316	0	720	404	404	0	0	0.000	3.913
JUL	451	0	0	293	0	744	451	451	0	0	0.000	3.913
AUG	489	0	0	255	0	744	489	489	0	0	0.000	3.913
SEP	325	0	0	395	0	656	389	389	0	64	0.000	3.913
OCT	4	0	0	20	0	13	15	15	0	11	0.000	0.065
ANNUAL	1854	5	0	1501	24	3261	1940	1940	0	81		

EMC ENGINEERS INC. EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/ 6/1995 16:41:21 SDL RUN 1
DENVER, CO 80227 PROPOSED MODIFICATION OF BLDG. #7243 ADM. & SUPPLY BLDG
REPORT- SS-A SYSTEM MONTHLY LOADS SUMMARY FOR H&V TOPEKA, KS

MONTH	COOLING: COOLING ENERGY (MBTU)	COOLING: TIME OF MAX DY HR	COOLING: DRY-BULB TEMP	COOLING: WET-BULB TEMP	COOLING: MAXIMUM COOLING LOAD (KBTU/HR)	HEATING: HEATING ENERGY (MBTU)	HEATING: TIME OF MAX DY HR	HEATING: DRY-BULB TEMP	HEATING: WET-BULB TEMP	HEATING: MAXIMUM HEATING LOAD (KBTU/HR)	ELEC: ELECTRICAL ENERGY (KWH)	ELEC: MAXIMUM ELEC LOAD (KW)
MAY	0.00000				0.000	-0.015	15 23	66.F	63.F	-1.761	5930.	28.552
JUN	0.00000				0.000	0.000				0.000	10961.	28.552
JUL	0.00000				0.000	0.000				0.000	10802.	28.552
AUG	0.00000				0.000	0.000				0.000	11378.	28.552
SEP	0.00000				0.000	0.000				0.000	10770.	28.552
OCT	0.00000				0.000	0.000				0.000	225.	9.360
TOTAL	0.000					-0.015					50065.	
MAX					0.000					-1.761		28.552

EMC ENGINEERS INC. EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/ 6/1995 16:41:21 SDL RUN 1
DENVER, CO 80227 PROPOSED MODIFICATION OF BLDG. #7243 ADM. & SUPPLY BLDG
REPORT- SS-C SYSTEM MONTHLY LOAD HOURS FOR H&V TOPEKA, KS

MONTH	HOURS COOLING LOAD	HOURS HEATING LOAD	HOURS COINCIDENT COOL-HEAT LOAD	HOURS FLOATING	HOURS HEATING AVAIL.	HOURS COOLING AVAIL.	HOURS FANS ON	HOURS FANS CYCLE ON	HOURS NIGHT VENTING	HOURS FLOATING WHEN FANS ON	COINCIDENT LOADS: HEATING LOAD AT COOLING PEAK (KBTU/HR)	COINCIDENT LOADS: ELECTRIC LOAD AT COOLING PEAK (KW)
MAY	0	12	0	396	24	0	408	0	0	396	0.000	9.360
JUN	0	0	0	720	0	0	720	0	0	720	0.000	9.360
JUL	0	0	0	744	0	0	744	0	0	744	0.000	9.360
AUG	0	0	0	744	0	0	744	0	0	744	0.000	9.360
SEP	0	0	0	720	0	0	720	0	0	720	0.000	9.360
OCT	0	0	0	24	0	0	24	0	0	24	0.000	9.360
ANNUAL	0	12	0	3348	24	0	3360	0	0	3348		

EMC ENGINEERS INC. EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/ 6/1995 16:41:21 SDL RUN 1
DENVER, CO 80227 PROPOSED MODIFICATION OF BLDG. #7243 ADM. & SUPPLY BLDG
REPORT- SS-A SYSTEM MONTHLY LOADS SUMMARY FOR SMALL_SZ#3 TOPEKA, KS

	COOLING						HEATING						ELEC	
MONTH	COOLING ENERGY (MBTU)	TIME OF MAX DY	TIME OF MAX HR	DRY-BULB TEMP	WET-BULB TEMP	MAXIMUM COOLING LOAD (KBTU/HR)	HEATING ENERGY (MBTU)	TIME OF MAX DY	TIME OF MAX HR	DRY-BULB TEMP	WET-BULB TEMP	MAXIMUM HEATING LOAD (KBTU/HR)	ELEC-TRICAL ENERGY (KWH)	MAXIMUM ELEC LOAD (KW)
MAY	3.56298	31	12	84.F	74.F	46.437	-0.001	15	23	66.F	63.F	-0.396	435.	3.913
JUN	10.35086	20	13	86.F	76.F	47.456	0.000					0.000	872.	3.913
JUL	13.05706	1	16	86.F	80.F	54.208	0.000					0.000	799.	3.913
AUG	14.42620	24	16	96.F	77.F	50.392	0.000					0.000	917.	3.913
SEP	7.75137	6	16	93.F	76.F	50.534	0.000					0.000	834.	3.913
OCT	0.03686	1	17	85.F	68.F	14.932	0.000					0.000	1.	0.065
TOTAL	49.185						-0.001						3858.	
MAX						54.208						-0.396		3.913

EMC ENGINEERS INC. EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/ 6/1995 16:41:21 SDL RUN 1
DENVER, CO 80227 PROPOSED MODIFICATION OF BLDG. #7243 ADM. & SUPPLY BLDG
REPORT- SS-C SYSTEM MONTHLY LOAD HOURS FOR SMALL_SZ#3 TOPEKA, KS

	NUMBER OF HOURS										COINCIDENT LOADS	
MONTH	HOURS COOLING LOAD	HOURS HEATING LOAD	HOURS COINCIDENT COOL-HEAT LOAD	HOURS FLOATING	HOURS HEATING AVAIL.	HOURS COOLING AVAIL.	HOURS FANS ON	HOURS FANS CYCLE ON	HOURS NIGHT VENTING	HOURS FLOATING WHEN FANS ON	HEATING LOAD AT COOLING PEAK (KBTU/HR)	ELECTRIC LOAD AT COOLING PEAK (KW)
MAY	177	4	0	227	24	384	187	187	0	6	0.000	3.913
JUN	400	0	0	320	0	720	400	400	0	0	0.000	3.913
JUL	451	0	0	293	0	744	451	451	0	0	0.000	3.913
AUG	487	0	0	257	0	744	487	487	0	0	0.000	3.913
SEP	320	0	0	400	0	644	396	396	0	76	0.000	3.913
OCT	3	0	0	21	0	13	14	14	0	11	0.000	0.065
ANNUAL	1838	4	0	1518	24	3249	1935	1935	0	93		

EMC ENGINEERS INC. EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/ 6/1995 16:41:21 SDL RUN 1
DENVER, CO 80227 PROPOSED MODIFICATION OF BLDG. #7243 ADM. & SUPPLY BLDG
REPORT- SS-A SYSTEM MONTHLY LOADS SUMMARY FOR SMALL_SZ#4 TOPEKA, KS

MONTH	COOLING: COOLING ENERGY (MBTU)	COOLING: TIME OF MAX DY	COOLING: TIME OF MAX HR	COOLING: DRY-BULB TEMP	COOLING: WET-BULB TEMP	COOLING: MAXIMUM COOLING LOAD (KBTU/HR)	HEATING: HEATING ENERGY (MBTU)	HEATING: TIME OF MAX DY	HEATING: TIME OF MAX HR	HEATING: DRY-BULB TEMP	HEATING: WET-BULB TEMP	HEATING: MAXIMUM HEATING LOAD (KBTU/HR)	ELEC: ELEC-TRICAL ENERGY (KWH)	ELEC: MAXIMUM ELEC LOAD (KW)
MAY	3.58158	31	12	84.F	74.F	46.364	-0.001	15	23	66.F	63.F	-0.383	436.	3.913
JUN	10.32119	20	13	86.F	76.F	47.304	0.000					0.000	873.	3.913
JUL	12.76184	1	16	86.F	80.F	53.980	0.000					0.000	798.	3.913
AUG	14.18440	24	16	96.F	77.F	50.089	0.000					0.000	916.	3.913
SEP	7.79198	6	16	93.F	76.F	50.334	0.000					0.000	833.	3.913
OCT	0.04606	1	18	83.F	68.F	14.650	0.000					0.000	1.	0.065
TOTAL	48.687						-0.001						3857.	
MAX						53.980						-0.383		3.913

EMC ENGINEERS INC. EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/ 6/1995 16:41:21 SDL RUN 1
DENVER, CO 80227 PROPOSED MODIFICATION OF BLDG. #7243 ADM. & SUPPLY BLDG
REPORT- SS-C SYSTEM MONTHLY LOAD HOURS FOR SMALL_SZ#4 TOPEKA, KS

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MONTH	HOURS COOLING LOAD	HOURS HEATING LOAD	HOURS COINCIDENT COOL-HEAT LOAD	HOURS FLOATING	HOURS HEATING AVAIL.	HOURS COOLING AVAIL.	HOURS FANS ON	HOURS FANS CYCLE ON	HOURS NIGHT VENTING	HOURS FLOATING WHEN FANS ON	COINCIDENT LOADS: HEATING LOAD AT COOLING PEAK (KBTU/HR)	COINCIDENT LOADS: ELECTRIC LOAD AT COOLING PEAK (KW)
MAY	180	5	0	223	24	384	191	191	0	6	0.000	3.913
JUN	403	0	0	317	0	720	403	403	0	0	0.000	3.913
JUL	445	0	0	299	0	744	445	445	0	0	0.000	3.913
AUG	484	0	0	260	0	744	484	484	0	0	0.000	3.913
SEP	325	0	0	395	0	655	390	390	0	65	0.000	3.913
OCT	4	0	0	20	0	13	15	15	0	11	0.000	0.065
ANNUAL	1841	5	0	1514	24	3260	1928	1928	0	82		

EMC ENGINEERS INC. EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/ 6/1995 16:41:21 SDL RUN 1
DENVER, CO 80227 PROPOSED MODIFICATION OF BLDG. #7243 ADM. & SUPPLY BLDG
REPORT- SS-A SYSTEM MONTHLY LOADS SUMMARY FOR SMALL_SZ#5 TOPEKA, KS

MONTH	COOLING: COOLING ENERGY (MBTU)	COOLING: TIME OF MAX DY	COOLING: TIME OF MAX HR	COOLING: DRY-BULB TEMP	COOLING: WET-BULB TEMP	COOLING: MAXIMUM COOLING LOAD (KBTU/HR)	HEATING: HEATING ENERGY (MBTU)	HEATING: TIME OF MAX DY	HEATING: TIME OF MAX HR	HEATING: DRY-BULB TEMP	HEATING: WET-BULB TEMP	HEATING: MAXIMUM HEATING LOAD (KBTU/HR)	ELEC: ELECTRICAL ENERGY (KWH)	ELEC: MAXIMUM ELEC LOAD (KW)
MAY	3.58066	31	12	84.F	74.F	46.364	-0.001	15	23	66.F	63.F	-0.383	436.	3.913
JUN	10.32143	20	13	86.F	76.F	47.306	0.000					0.000	873.	3.913
JUL	12.76211	1	16	86.F	80.F	53.981	0.000					0.000	798.	3.913
AUG	14.18472	24	16	96.F	77.F	50.088	0.000					0.000	916.	3.913
SEP	7.79025	6	16	93.F	76.F	50.334	0.000					0.000	833.	3.913
OCT	0.04586	1	18	83.F	68.F	14.600	0.000					0.000	1.	0.065
TOTAL	48.685						-0.001						3857.	
MAX						53.981						-0.383		3.913

EMC ENGINEERS INC. EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/ 6/1995 16:41:21 SDL RUN 1
DENVER, CO 80227 PROPOSED MODIFICATION OF BLDG. #7243 ADM. & SUPPLY BLDG
REPORT- SS-C SYSTEM MONTHLY LOAD HOURS FOR SMALL_SZ#5 TOPEKA, KS

MONTH	HOURS COOLING LOAD	HOURS HEATING LOAD	HOURS COINCIDENT COOL-HEAT LOAD	HOURS FLOATING	HOURS HEATING AVAIL.	HOURS COOLING AVAIL.	HOURS FANS ON	HOURS FANS CYCLE ON	HOURS NIGHT VENTING	HOURS FLOATING WHEN FANS ON	COINCIDENT LOADS: HEATING LOAD AT COOLING PEAK (KBTU/HR)	COINCIDENT LOADS: ELECTRIC LOAD AT COOLING PEAK (KW)
MAY	180	5	0	223	24	384	191	191	0	6	0.000	3.913
JUN	403	0	0	317	0	720	403	403	0	0	0.000	3.913
JUL	445	0	0	299	0	744	445	445	0	0	0.000	3.913
AUG	484	0	0	260	0	744	484	484	0	0	0.000	3.913
SEP	325	0	0	395	0	655	390	390	0	65	0.000	3.913
OCT	4	0	0	20	0	13	15	15	0	11	0.000	0.065
ANNUAL	1841	5	0	1514	24	3260	1928	1928	0	82		

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EMC      ENGINEERS      INC.      EZDOE - ELITE SOFTWARE DEVELOPMENT INC      DOE-2.1D   2/ 6/1995    16:41:21  PDL RUN 1
DENVER,     CO         80227      PROPOSED MODIFICATION OF BLDG. #7243    ADM. & SUPPLY BLDG
REPORT- PS-B  MONTHLY PEAK AND TOTAL ENERGY USE                                  TOPEKA, KS
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MO	UTILITY-	ELECTRICITY	NATURAL-GAS
	TOTAL(MBTU)	33.938	0.028
MAY	PEAK(KBTU)	225.272	4.620
	DY/HR	31/12	15/23
	TOTAL(MBTU)	69.547	0.000
JUN	PEAK(KBTU)	227.128	0.000
	DY/HR	24/13	30/ 1
	TOTAL(MBTU)	72.657	0.000
JUL	PEAK(KBTU)	237.577	0.000
	DY/HR	1/16	31/ 1
	TOTAL(MBTU)	77.991	0.000
AUG	PEAK(KBTU)	231.881	0.000
	DY/HR	24/16	31/ 1
	TOTAL(MBTU)	63.898	0.000
SEP	PEAK(KBTU)	230.847	0.000
	DY/HR	6/16	30/ 1
	TOTAL(MBTU)	0.954	0.000
OCT	PEAK(KBTU)	61.832	0.000
	DY/HR	1/18	1/ 1
	ONE YEAR	318.984	0.028
	USE/PEAK	237.577	4.620


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EMC      ENGINEERS      INC.      EZDOE - ELITE SOFTWARE DEVELOPMENT INC      DOE-2.1D   2/ 6/1995    16:41:21  PDL RUN 1
DENVER,     CO         80227      PROPOSED MODIFICATION OF BLDG. #7243    ADM. & SUPPLY BLDG
REPORT- BEPS  ESTIMATED BUILDING ENERGY PERFORMANCE                              TOPEKA, KS
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ENERGY TYPE IN SITE MBTU - CATEGORY OF USE	ELECTRICITY	NATURAL-GAS
SPACE HEAT	0.00	0.03
SPACE COOL	74.26	0.00
HVAC AUX	117.43	0.00
DOM HOT WTR	0.00	0.00
AUX SOLAR	0.00	0.00
LIGHTS	113.06	0.00
VERT TRANS	0.00	0.00
MISC EQUIP	14.24	0.00
TOTAL	318.98	0.03

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TOTAL SITE ENERGY       319.01 MBTU     13.6 KBTU/SQFT-YR GROSS-AREA     15.3 KBTU/SQFT-YR NET-AREA
TOTAL SOURCE ENERGY     957.94 MBTU     40.8 KBTU/SQFT-YR GROSS-AREA     46.0 KBTU/SQFT-YR NET-AREA
PERCENT OF HOURS ANY SYSTEM ZONE OUTSIDE OF THROTTLING RANGE = 16.7
PERCENT OF HOURS ANY PLANT LOAD NOT SATISFIED                =  0.0
NOTE  ELECTRICITY AND/OR FUEL USED TO GENERATE ELECTRICITY IS APPORTIONED BASED
      ON THE YEARLY DEMAND.  ALL OTHER ENERGY TYPES ARE APPORTIONED HOURLY.
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BUILDING 7602
ANNUAL ENERGY SAVINGS SUMMARY

Item	Baseline	ECO	Annual Energy Savings	Adj. Annual Energy Savings*
Annual Electric (MBTU)	363.90	316.01	47.89	24.93
Annual Natural Gas (MBTU)			0.00	0.00
Electric Demand June (KW)	70.99	64.07	6.91	3.60
Electric Demand July (KW)	72.60	66.89	5.71	2.97
Electric Demand August (KW)	73.42	65.42	8.00	4.17

*Energy savings prorated on a square foot basis:

Baseline Model Bldg 8021 (sq.ft.)	22517.5
ECO Model Bldg 7602 (sq.ft.)	11723.5
Square Footage Adjustment Factor	0.521

LIFE CYCLE COST ANALYSIS SUMMARY
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

LOCATION:	Fort Riley	REGION: 2 (Kansas)		PROJECT NO:	1406-005
PROJECT TITLE:	Feasibility Study for HVAC Upgrade			FISCAL YEAR:	1995
ANALYSIS DATE:	05/04/95	ECONOMIC LIFE:	20	PREPARED BY:	C. Wohlert

1. INVESTMENT: **BLDG 7602 - Replace Existing SZ Cooling AHUs w/ New SZ Cooling AHUs**

A.	CONSTRUCTION COST	=	$21,599	
B.	SIOH COST	(5.5% of 1A) =	$1,188	
C.	DESIGN COST	(6.0% of 1A) =	$1,296	
D.	TOTAL COST	(1A +1B +1C) =	$24,083	
E.	SALVAGE VALUE OF EXISTING EQUIPMENT	=	$0	
F.	PUBLIC UTILITY COMPANY REBATE	=	$0	
G.	TOTAL INVESTMENT	(1D -1E -1F) =	------->	$24,083

2. ENERGY SAVINGS (+) OR COST (-):

DATE OF NISTR 85-3273-9 USED FOR DISCOUNT FACTORS: JAN '95

	ENERGY SOURCE	FUEL COST $/MBTU (1)	SAVINGS MBTU/YR (2)	ANNUAL $ SAVINGS (3)	DISCOUNT FACTOR (4)	DISCOUNTED SAVINGS (5)	
A.	ELECT.	$12.10	25	$302	15.88	$4,790	
B.	DIST	$0.00	0	$0	19.16	$0	
C.	NAT GAS	$4.12	0	$0	18.30	$0	
D.	COAL	$0.00	0	$0	16.62	$0	
E.	ELEC. DEMAND			$213	14.88	$3,170	
F.	TOTAL		25	$515		-------->	$7,960

3. NON-ENERGY SAVINGS (+) OR COST (-)

A. ANNUAL RECURRING (+/-)

1	ANNUAL MAINTENANCE	$0	14.88	$0
2		$0	14.88	$0
3		$0	14.88	$0
4	TOTAL ANNUAL DISC. SAVINGS (+) / COST	$0		$0

B. NON-RECURRING (+/-)

ITEM	SAVINGS (+) COST(-) (1)	YEAR OF OCCURRENCE (2)	DISCOUNT FACTOR (3) (TABLE A-2)	DISCOUNTED SAVINGS/COST (4)
a. BASELINE EQUIP. REPLACEMEN	$20,550	5	0.863	$17,735
b.				$0
c.				$0
d.				$0
e.				$0
f. TOTAL	$20,550			$17,735

C. TOTAL NON-ENERGY DISCOUNTED SAVINGS (+) OR COST (-) (3A4 + 3Bf4) = $17,735

4.	FIRST YEAR DOLLAR SAVINGS (+) / COSTS (-)	(2F3+3A4+(3Bf1/Economic Life))	$1,542
5.	SIMPLE PAYBACK (SPB) IN YEARS (MUST BE < 10 YEARS TO QUALIFY)	(1G/4) =	15.62
6.	TOTAL NET DISCOUNTED SAVINGS	(2F5 + 3C) =	$25,695
7.	DISCOUNTED SAVINGS-TO-INVESTMENT RATIO (SIR) (MUST HAVE SIR > 1.25 TO QUALIFY)	(6/1G) =	1.07

ENGINEER'S OPINION OF PROBABLE COST

PROJECT	Fort Riley Feasibility Study for HVAC Upgrade	**SHEET**	1 OF 1
		DATE PREPARED	4-May-95
ENGINEER	E M C Engineers, Inc.	**ESTIMATOR**	C. Wohlert
	Denver, CO	**CHECKED BY**	A. Niemeyer

Line No.	Item Refer Code	Item Description	Unit of Measure	MATERIAL COST Quantity	MATERIAL COST Unit Cost	MATERIAL COST Total	LABOR COST Crew/ Worker	LABOR COST Hours/ Unit	LABOR COST Total	TOTAL
1		**BUILDING 7602**								
2		**PROPOSED SYSTEM MODIFICATIONS**								
3										
4		*NEW SYSTEMS INSTALLATION*								
5	STLPIP1.25	STEEL PIPE SCH. 40, 1.25" W/HANGERS	L.F.	50.0	$3	$128	Q-1	0.20	$194	$322
6	WCHLR1	VALVES AND FITTINGS ADD 15%	EA.			$19			$29	$48
7	INSLPIP1.2	1.25" FIBERGLASS PIPE INSULATION, 1.5" THCK	L.F.	50.0	$1.40	$70	Q-14	0.08	$74	$143
8	DUCT500	GAL. STEEL DUCTWORK, 200 TO 500 LB.	LB.	390.0	$0.47	$181	Q-10	0.10	$743	$924
9	E-TSTAT1	SINGLE SETPOINT ELEC. TSTAT, 3 WIRE	EA.	5.0	$24.23	$121	1-ELEC	0.80	$84	$205
10	WIRE#12	COPPER WIRING #12	C.L.F.	2.5	$7.41	$19	1-ELEC	0.73	$38	$57
11	PROPGLY	PROPYLENE GLYCOL FLUSH & FILL	GAL.	35.0	$6.49	$227	1-PLUM	0.14	$106	$333
12	AHU1300	1,300 CFM AHU, COOLING ONLY	EA.	5.0	$1,913.78	$9,569	Q-5	13.33	$1,292	$10,861
13										
14										
15										
16										
17										
18										
19										
20										
21										
22										
23										
24		*EXISTING SYSTEMS DEMOLITION*								
25		AHU DEMOLITION	TON	0.9			Q-5	17.78	$310	$310
26		DUCT DEMOLITION	TON	0.2			Q-5	17.78	$69	$69
27		PIPING DEMOLITION	L.F.	50.0			1-PLUM	0.05	$57	$57
28		ASBESTOS REMOVAL	GLV. BAG	4.0	$170.00	$680				$680
29										
30										
31		**SUBTOTAL**				$11,014			$2,995	$14,009
32	OH	OVERHEAD			17%	$1,850			$503	$2,354
33	PRO	PROFIT			10%	$1,286			$350	$1,636
34	CONT	CONTINGENCY			20%	$2,830			$770	$3,600
35	**TOTAL COST**		-	-	-	$16,981	-	-	$4,618	$21,599

ENGINEER'S OPINION OF PROBABLE COST

PROJECT	Fort Riley Feasibility Study for HVAC Upgrade	**SHEET**	1 **OF** 1
ENGINEER	E M C Engineers, Inc.	**DATE PREPARED**	4-May-95
	Denver, CO	**ESTIMATOR**	C. Wohlert
		CHECKED BY	A. Niemeyer

Line No.	Item Refer Code	Item Description	Unit of Measure	MATERIAL COST Quantity	MATERIAL COST Unit Cost	MATERIAL COST Total	LABOR COST Crew/ Worker	LABOR COST Hours/ Unit	LABOR COST Total	TOTAL
1		**BUILDING 7602**								
2		**NON-RECURRING**								
3										
4		*BASELINE - EXISTING EQUIP. REPLACEMENT*								
5	STLPIP1.2	STEEL PIPE SCH. 40, 1.25" W/HANGERS	L.F.	50.0	$2.56	$128	Q-1	0.2	$194	$322
6	AHU5400	VALVES AND FITTINGS ADD 15%	EA.			$19			$29	$48
7	INSLPIP1.	1.25" FIBERGLASS PIPE INSULATION, 1.5" THCK	L.F.	50.0	$1.40	$70	Q-14	0.08	$74	$143
8	DUCT500	GAL. STEEL DUCTWORK, 200 TO 500 LB.	LB.	390.0	$0.47	$181	Q-10	0.098	$743	$924
9	E-TSTAT1	SINGLE SETPOINT ELEC. TSTAT, 3 WIRE	EA.	5.0	$24.23	$121	1-ELEC	0.8	$84	$205
10	WIRE#12	COPPER WIRING #12	C.L.F.	2.5	$7.41	$19	1-ELEC	0.727	$38	$57
11	PROPGLY	PROPYLENE GLYCOL FLUSH & FILL	GAL.	35.0	$6.49	$227	1-PLUM	0.14	$106	$333
12	AHU1300	1,300 CFM AHU, COOLING ONLY	EA.	5.0	$1,913.78	$9,569	Q-5	13.33	$1,292	$10,861
13										
14										
15										
16										
17										
18										
19										
20										
21										
22										
23										
24		*EXISTING SYSTEMS DEMOLITION*								
25		AHU DEMOLITION	TON	0.9			Q-5	17.78	$310	$310
26		DUCT DEMOLITION	TON	0.2			Q-5	17.78	$69	$69
27		PIPING DEMOLITION	L.F.	50.0			1-PLUM	0.05	$57	$57
28										
29										
30										
31		**SUBTOTAL**				$10,334			$2,995	$13,329
32	OH	OVERHEAD			17%	$1,736			$503	$2,239
33	PRO	PROFIT			10%	$1,207			$350	$1,557
34	CONT	CONTINGENCY			20%	$2,655			$770	$3,425
35	**TOTAL COST**		-	-	-	$15,933	-	-	$4,618	$20,550

ENGINEER'S OPINION OF PROBABLE COST

PROJECT	Fort Riley Feasibility Study for HVAC Upgrade	SHEET	1 OF 1
ENGINEER	E M C Engineers, Inc.	DATE PREPARED	4-May-95
	Denver, CO	ESTIMATOR	C. Wohlert
		CHECKED BY	A. Niemeyer

Line No.	Item Refer Code	Item Description	Unit of Measure	MATERIAL COST Quantity	MATERIAL COST Unit Cost	MATERIAL COST Total	LABOR COST Crew/ Worker	LABOR COST Hours/ Unit	LABOR COST Total	TOTAL
1		**BUILDING 7602**								
2		***ANNUAL RECURRING***								
3		***ANNUAL MAINTENANCE COST - BASELINE***								
4										
5										
6										
7										
8										
9										
10										
11										
12										
13										
14										
15	TOTAL ANNUAL MAINTENANCE COST - BASELINE		-	-	-	$0	-	-	$0	$0
16										
17		***ANNUAL MAINTENANCE COST - NEW HVAC REPLACEMENT***								
18										
19										
20										
21										
22										
23										
24										
25										
26										
27										
28										
29	TOTAL ANNUAL MAINTENANCE COST - BASELINE		-	-	-	$0	-	-	$0	$0
30										
31										
32										
33										
34										
35	TOTAL ANNUAL MAINTENANCE COST SAVINGS		-	-	-	$0	-	-	$0	$0

DEMAND LIMITING ANALYSIS BUILDING 7602

SUMMER PEAK (KW) = 27812	1993 JUL BILL 7/1-8/2 ACTUAL	1993 AUG BILL 8/2-9/1 ACTUAL	1993 SEP BILL 9/3-10/1 ACTUAL	1993 OCT BILL 10/1-11/1 ACTUAL	1993 NOV BILL 11/1-12/1 ACTUAL	1993 DEC BILL 12/1-1/3 ACTUAL	1993 JAN BILL 1/4-2/1 ACTUAL	1993 FEB BILL 2/1-3/1 ACTUAL	1993 MAR BILL 3/3-4/1 ACTUAL	1993 APR BILL 4/1-5/3 ACTUAL	1993 MAY BILL 5/3-6/1 ACTUAL	1993 JUN BILL 6/1-7/1 ACTUAL
BASE CASE												
CAPACITY (KW)	32472	34452	26136	20754	26400	22752	27108	25812	23310	21834	21996	30096
POWER FACTOR (%)	99.20%	99.10%	99.10%	99.90%	99.80%	99.70%	99.50%	99.60%	99.60%	99.80%	99.60%	98.80%
CAPACITY (KVA)	32734	34765	26373	20775	26453	22820	27244	25916	23404	21878	22084	30462
80% SUMMER PEAK (KVA)	27812	27812	27812	27812	27812	27812	27812	27812	27812	27812	27812	27812
CONTRACT MINIMUM (KVA)	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643
BILLING CAPACITY (KVA)	32734	34765	27812	27812	27812	27812	27812	27812	27812	27812	27812	30462
ACTUAL OR 80% PEAK	ACTUAL	ACTUAL	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	ACTUAL
200 KVA @ $4.45	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00
NEXT 400 @ $4.25	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00
REMAINING @ $4.05	$130,142.18	$138,367.78	$110,208.22	$110,208.22	$110,208.22	$110,208.22	$110,208.22	$110,208.22	$110,208.22	$110,208.22	$110,208.22	$120,939.23
SUB DISCOUNT $.20	($6,546.77)	($6,952.98)	($5,562.38)	($5,562.38)	($5,562.38)	($5,562.38)	($5,562.38)	($5,562.38)	($5,562.38)	($5,562.38)	($5,562.38)	($6,092.31)
CAPACITY CHARGE	$126,185.40	$134,004.80	$107,235.84	$107,235.84	$107,235.84	$107,235.84	$107,235.84	$107,235.84	$107,235.84	$107,235.84	$107,235.84	$117,436.92
TOTAL ENERGY (KWH)	16,920,000	16,200,000	10,980,000	10,140,000	11,160,000	12,930,000	12,600,000	12,270,000	12,480,000	11,070,000	9,720,000	13,170,000
50*KVA @ $.03924	$64,223.85	$68,208.70	$54,566.96	$54,566.96	$54,566.96	$54,566.96	$54,566.96	$54,566.96	$54,566.96	$54,566.96	$54,566.96	$59,765.54
100*KVA @ $.03404	$111,426.10	$118,339.66	$94,671.73	$94,671.73	$94,671.73	$94,671.73	$94,671.73	$94,671.73	$94,671.73	$94,671.73	$94,671.73	$103,691.08
250*KVA @ $.03084	$252,378.15	$268,037.26	$209,965.32	$184,059.72	$214,429.80	$214,429.80	$214,429.80	$214,429.80	$214,429.80	$212,740.92	$171,106.92	$234,858.46
EXCESS @ $.02864	$109,589.57	$65,701.49	$0.00	$0.00	$1,009.19	$51,701.99	$42,250.79	$32,799.59	$38,813.99	$0.00	$0.00	$28,221.42
ENERGY CHARGE	$537,617.67	$520,287.11	$359,204.01	$333,298.41	$364,677.69	$415,370.49	$405,919.29	$396,468.09	$402,482.49	$361,979.61	$320,345.61	$426,536.49
TOTAL CHARGE LESS ECA	$663,803.07	$654,291.92	$466,439.85	$440,534.25	$471,913.53	$522,606.33	$513,155.13	$503,703.93	$509,718.33	$469,215.45	$427,581.45	$543,973.42
DEMAND REDUCTION (KW)	**2.97**	**4.17**	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**3.60**
CAPACITY (KW)	32469	34448	26136	20754	26400	22752	27108	25812	23310	21834	21996	30092
POWER FACTOR (%)	99.20%	99.10%	99.10%	99.90%	99.80%	99.70%	99.50%	99.60%	99.60%	99.80%	99.60%	98.80%
CAPACITY (KVA)	32731	34761	26373	20775	26453	22820	27244	25916	23404	21878	22084	30458
80% SUMMER PEAK (KVA)	27809	27809	27809	27809	27809	27809	27809	27809	27809	27809	27809	27809
CONTRACT MINIMUM (KVA)	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643
BILLING CAPACITY (KVA)	32731	34761	27809	27809	27809	27809	27809	27809	27809	27809	27809	30458
ACTUAL OR 80% PEAK	ACTUAL	ACTUAL	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	ACTUAL
200 KVA @ $4.45	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00
NEXT 400 @ $4.25	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00
REMAINING @ $4.05	$130,130.04	$138,350.76	$110,194.61	$110,194.61	$110,194.61	$110,194.61	$110,194.61	$110,194.61	$110,194.61	$110,194.61	$110,194.61	$120,924.48
SUB DISCOUNT $.20	($6,546.18)	($6,952.14)	($5,561.71)	($5,561.71)	($5,561.71)	($5,561.71)	($5,561.71)	($5,561.71)	($5,561.71)	($5,561.71)	($5,561.71)	($6,091.58)
CAPACITY CHARGE	$126,173.87	$133,988.62	$107,222.90	$107,222.90	$107,222.90	$107,222.90	$107,222.90	$107,222.90	$107,222.90	$107,222.90	$107,222.90	$117,422.90
TOTAL ENERGY (KWH)	16,920,000	16,200,000	10,980,000	10,140,000	11,160,000	12,930,000	12,600,000	12,270,000	12,480,000	11,070,000	9,720,000	13,170,000
50*KVA @ $.03924	$64,217.98	$68,200.46	$54,560.36	$54,560.36	$54,560.36	$54,560.36	$54,560.36	$54,560.36	$54,560.36	$54,560.36	$54,560.36	$59,758.39
100*KVA @ $.03404	$111,415.90	$118,325.36	$94,660.29	$94,660.29	$94,660.29	$94,660.29	$94,660.29	$94,660.29	$94,660.29	$94,660.29	$94,660.29	$103,678.67
250*KVA @ $.03084	$252,355.05	$268,004.85	$209,980.87	$184,075.27	$214,403.88	$214,403.88	$214,403.88	$214,403.88	$214,403.88	$212,756.47	$171,122.47	$234,830.37
EXCESS @ $.02864	$109,623.89	$65,749.64	$0.00	$0.00	$1,047.71	$51,740.51	$42,289.31	$32,838.11	$38,852.51	$0.00	$0.00	$28,263.15
ENERGY CHARGE	$537,612.82	$520,280.30	$359,201.52	$333,295.92	$364,672.24	$415,365.04	$405,913.84	$396,462.64	$402,477.04	$361,977.12	$320,343.12	$426,530.59
TOTAL CHARGE LESS ECA	$663,786.69	$654,268.92	$466,424.42	$440,518.82	$471,895.14	$522,587.94	$513,136.74	$503,685.54	$509,699.94	$469,200.02	$427,566.02	$543,953.49
SUMMARY												
MONTHLY DIFFERENCE	$16.39	$22.99	$15.43	$15.43	$18.39	$18.39	$18.39	$18.39	$18.39	$15.43	$15.43	$19.93
ANNUAL DIFFERENCE.............		**$213.01**										

NUMBER OF EXTERIOR SURFACES 27 RECTANGULAR 27 OTHER 0
(U-VALUE INCLUDES INSIDE AIR FILM PLUS OUTSIDE AIR FILM AT 7.5 MPH WINDSPEED)

SURFACE	SPACE	- - - - G L A S S - - - - U-VALUE (BTU/HR-SQFT-F)	AREA (SQFT)	- - - - W A L L - - - - U-VALUE (BTU/HR-SQFT-F)	AREA (SQFT)	- W A L L + G L A S S - U-VALUE (BTU/HR-SQFT-F)	AREA (SQFT)	AZIMUTH
	1ST_COMPNY	1.021	144.00	0.096	456.00	0.318	600.00	SOUTH-EAST
	2-COMPNY	1.021	144.00	0.096	456.00	0.318	600.00	SOUTH-EAST
	5TH_COMPNY	1.021	144.00	0.096	456.00	0.318	600.00	SOUTH-EAST
	3-COMPNY	1.021	144.00	0.096	456.00	0.318	600.00	SOUTH-EAST
	4-COMPNY	1.021	144.00	0.096	456.00	0.318	600.00	SOUTH-EAST
	5TH_COMPNY	0.000	0.00	0.096	420.00	0.096	420.00	SOUTH-WEST
	5EQUPMAIN	0.000	0.00	0.096	767.00	0.096	767.00	SOUTH-WEST
	1EQUPMAIN	0.000	0.00	0.096	650.00	0.096	650.00	NORTH-WEST
	2-EQUPMAN	0.000	0.00	0.096	650.00	0.096	650.00	NORTH-WEST
	3-EQUPMAN	0.000	0.00	0.096	650.00	0.096	650.00	NORTH-WEST
	5EQUPMAIN	0.000	0.00	0.096	650.00	0.096	650.00	NORTH-WEST
	4-EQUPMAN	0.000	0.00	0.096	650.00	0.096	650.00	NORTH-WEST
	5TH_COMPNY	0.000	0.00	0.020	1334.00	0.020	1334.00	ROOF
	5-VALT	0.000	0.00	0.020	340.00	0.020	340.00	ROOF
	2-COMPNY	0.000	0.00	0.020	1334.00	0.020	1334.00	ROOF
	2-VALT	0.000	0.00	0.020	340.00	0.020	340.00	ROOF
	5EQUPMAIN	0.000	0.00	0.127	2950.00	0.127	2950.00	ROOF
	1ST_COMPNY	0.000	0.00	0.020	1334.00	0.020	1334.00	ROOF
	3-COMPNY	0.000	0.00	0.020	1334.00	0.020	1334.00	ROOF
	3-VALT	0.000	0.00	0.020	340.00	0.020	340.00	ROOF
	2-EQUPMAN	0.000	0.00	0.127	2950.00	0.127	2950.00	ROOF
	3-EQUPMAN	0.000	0.00	0.127	2950.00	0.127	2950.00	ROOF

EMC ENGINEERS INC. EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/ 6/1995 15: 1:52 LDL RUN 1
DENVER, CO 80227 EXISTING CONDITION OF BLDG. #7602 ADMIN & SUPP BLDG
REPORT- LV-D DETAILS OF EXTERIOR SURFACES IN THE PROJECT TOPEKA, KS

	1EQUPMAIN	0.000	0.00	0.127	2950.00	0.127	2950.00	ROOF
	4-COMPNY	0.000	0.00	0.020	1334.00	0.020	1334.00	ROOF
	4-VALT	0.000	0.00	0.020	340.00	0.020	340.00	ROOF
	1ARMS-VALT	0.000	0.00	0.020	340.00	0.020	340.00	ROOF
	4-EQUPMAN	0.000	0.00	0.127	2950.00	0.127	2950.00	ROOF
	1ST_COMPNY	0.000	0.00	0.020	1334.00	0.020	1334.00	UNDERGRND
	1ARMS-VALT	0.000	0.00	0.020	340.00	0.020	340.00	UNDERGRND
	1EQUPMAIN	0.000	0.00	0.020	2950.00	0.020	2950.00	UNDERGRND
	2-COMPNY	0.000	0.00	0.020	1334.00	0.020	1334.00	UNDERGRND
	2-VALT	0.000	0.00	0.020	340.00	0.020	340.00	UNDERGRND
	2-EQUPMAN	0.000	0.00	0.020	2950.00	0.020	2950.00	UNDERGRND
	5TH_COMPNY	0.000	0.00	0.020	1334.00	0.020	1334.00	UNDERGRND
	5-VALT	0.000	0.00	0.020	340.00	0.020	340.00	UNDERGRND
	5EQUPMAIN	0.000	0.00	0.020	2950.00	0.020	2950.00	UNDERGRND
	3-COMPNY	0.000	0.00	0.020	1334.00	0.020	1334.00	UNDERGRND

3-VALT	0.000	0.00	0.020	340.00	0.020	340.00	UNDERGRND
3-EQUPMAN	0.000	0.00	0.020	2950.00	0.020	2950.00	UNDERGRND
4-COMPNY	0.000	0.00	0.020	1334.00	0.020	1334.00	UNDERGRND
4-VALT	0.000	0.00	0.020	340.00	0.020	340.00	UNDERGRND
4-EQUPMAN	0.000	0.00	0.020	2950.00	0.020	2950.00	UNDERGRND

	AVERAGE U-VALUE/GLASS (BTU/HR-SQFT-F)	AVERAGE U-VALUE/WALLS (BTU/HR-SQFT-F)	AVERAGE U-VALUE WALLS+GLASS (BTU/HR-SQFT-F)	GLASS AREA (SQFT)	OPAQUE AREA (SQFT)	GLASS+OPAQUE AREA (SQFT)
SOUTH-EAST	1.021	0.096	0.318	720.00	2280.00	3000.00
SOUTH-WEST	0.000	0.096	0.096	0.00	1187.00	1187.00
NORTH-WEST	0.000	0.096	0.096	0.00	3250.00	3250.00
ROOF	0.000	0.088	0.088	0.00	23120.00	23120.00
ALL WALLS	1.021	0.096	0.186	720.00	6717.00	7437.00
WALLS+ROOFS	1.021	0.090	0.112	720.00	29837.00	30557.00
UNDERGRND	0.000	0.020	0.020	0.00	23120.00	23120.00
BUILDING	1.021	0.059	0.072	720.00	52957.00	53677.00

REPORT- LS-C BUILDING PEAK LOAD COMPONENTS

*** BUILDING ***

FLOOR AREA	20818	SQFT	1934	SQMT
VOLUME	263970	CUFT	7476	CUMT

	COOLING LOAD				HEATING LOAD	
TIME	AUG 11	4PM			OCT 1	7AM
DRY-BULB TEMP	100F	38C			46F	8C
WET-BULB TEMP	71F	22C			44F	7C

	SENSIBLE (KBTU/H)	SENSIBLE (KW)	LATENT (KBTU/H)	LATENT (KW)	HEATING SENSIBLE (KBTU/H)	HEATING SENSIBLE (KW)
WALLS	17.321	5.073	0.000	0.000	-18.715	-5.481
ROOFS	76.283	22.341	0.000	0.000	-60.379	-17.683
GLASS CONDUCTION	14.119	4.135	0.000	0.000	-22.364	-6.550
GLASS SOLAR	53.275	15.603	0.000	0.000	2.360	0.691
DOOR	0.000	0.000	0.000	0.000	0.000	0.000
INTERNAL SURFACES	-5.695	-1.668	0.000	0.000	-5.695	-1.668
UNDERGROUND SURFACES	-2.027	-0.594	0.000	0.000	-3.116	-0.913
OCCUPANTS TO SPACE	41.902	12.272	65.945	19.314	1.613	0.472
LIGHT TO SPACE	102.646	30.062	0.000	0.000	6.074	1.779
EQUIPMENT TO SPACE	13.487	3.950	0.000	0.000	0.519	0.152
PROCESS TO SPACE	0.000	0.000	0.000	0.000	0.000	0.000
INFILTRATION	19.783	5.794	2.716	0.795	-17.645	-5.168
TOTAL	331.095	96.969	68.661	20.109	-117.348	-34.368
TOTAL LOAD	399.756 KBTU/H		117.078 KW		-117.348 KBTU/H	-34.368 KW
TOTAL LOAD / AREA	19.20BTU/H.SQFT		60.537 W /SQMT		5.637BTU/H.SQFT	17.770 W /SQMT

NOTE
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1)THE ABOVE LOADS EXCLUDE OUTSIDE VENTILATION AIR LOADS
2)TIMES GIVEN IN STANDARD TIME FOR THE LOCATION IN CONSIDERATION

EMC ENGINEERS INC. EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/ 6/1995 15: 1:52 SDL RUN 1
DENVER, CO 80227 EXISTING CONDITION OF BLDG. #7602 ADMIN & SUPP BLDG
REPORT- SS-A SYSTEM MONTHLY LOADS SUMMARY FOR SMALL_SZ#1 TOPEKA, KS

MONTH	COOLING: COOLING ENERGY (MBTU)	COOLING: TIME OF MAX DY	COOLING: TIME OF MAX HR	COOLING: DRY-BULB TEMP	COOLING: WET-BULB TEMP	COOLING: MAXIMUM COOLING LOAD (KBTU/HR)	HEATING: HEATING ENERGY (MBTU)	HEATING: TIME OF MAX DY	HEATING: TIME OF MAX HR	HEATING: DRY-BULB TEMP	HEATING: WET-BULB TEMP	HEATING: MAXIMUM HEATING LOAD (KBTU/HR)	ELEC: ELEC-TRICAL ENERGY (KWH)	ELEC: MAXIMUM ELEC LOAD (KW)
MAY	3.94869	31	16	88.F	75.F	41.034	-0.044	15	6	60.F	60.F	-7.467	450.	3.913
JUN	12.77651	27	16	89.F	77.F	44.801	0.000					0.000	893.	3.913
JUL	16.98791	1	16	86.F	80.F	51.049	0.000					0.000	818.	3.913
AUG	17.38310	23	16	96.F	77.F	47.198	0.000					0.000	933.	3.913
SEP	8.48008	7	15	92.F	76.F	45.509	0.000					0.000	855.	3.913
OCT	0.04668	1	17	85.F	68.F	10.675	0.000					0.000	2.	0.065
TOTAL	59.623						-0.044						3951.	
MAX						51.049						-7.467		3.913

EMC ENGINEERS INC. EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/ 6/1995 15: 1:52 SDL RUN 1
DENVER, CO 80227 EXISTING CONDITION OF BLDG. #7602 ADMIN & SUPP BLDG
REPORT- SS-C SYSTEM MONTHLY LOAD HOURS FOR SMALL_SZ#1 TOPEKA, KS

MONTH	HOURS COOLING LOAD	HOURS HEATING LOAD	HOURS COINCIDENT COOL-HEAT LOAD	HOURS FLOATING	HOURS HEATING AVAIL.	HOURS COOLING AVAIL.	HOURS FANS ON	HOURS FANS CYCLE ON	HOURS NIGHT VENTING	HOURS FLOATING WHEN FANS ON	COINCIDENT LOADS: HEATING LOAD AT COOLING PEAK (KBTU/HR)	COINCIDENT LOADS: ELECTRIC LOAD AT COOLING PEAK (KW)
MAY	271	16	0	121	24	272	408	0	0	121	0.000	3.913
JUN	636	0	0	84	0	638	720	0	0	84	0.000	3.913
JUL	728	0	0	16	0	729	744	0	0	16	0.000	3.913
AUG	727	0	0	17	0	727	744	0	0	17	0.000	3.913
SEP	450	0	0	270	0	457	720	0	0	270	0.000	3.913
OCT	6	0	0	18	0	7	24	0	0	18	0.000	0.065
ANNUAL	2818	16	0	526	24	2830	3360	0	0	526		

EMC ENGINEERS INC. EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/ 6/1995 15: 1:52 SDL RUN 1
DENVER, CO 80227 EXISTING CONDITION OF BLDG. #7602 ADMIN & SUPP BLDG
REPORT- SS-A SYSTEM MONTHLY LOADS SUMMARY FOR SMALL_SZ#2 TOPEKA, KS

	COOLING						HEATING						ELEC	
MONTH	COOLING ENERGY (MBTU)	TIME OF MAX DY	TIME OF MAX HR	DRY-BULB TEMP	WET-BULB TEMP	MAXIMUM COOLING LOAD (KBTU/HR)	HEATING ENERGY (MBTU)	TIME OF MAX DY	TIME OF MAX HR	DRY-BULB TEMP	WET-BULB TEMP	MAXIMUM HEATING LOAD (KBTU/HR)	ELEC-TRICAL ENERGY (KWH)	MAXIMUM ELEC LOAD (KW)
MAY	3.99891	31	16	88.F	75.F	40.936	-0.044	15	6	60.F	60.F	-7.402	450.	3.913
JUN	12.97530	27	16	89.F	77.F	44.728	0.000					0.000	893.	3.913
JUL	17.31594	1	16	86.F	80.F	51.007	0.000					0.000	818.	3.913
AUG	17.67966	23	16	96.F	77.F	47.176	0.000					0.000	933.	3.913
SEP	8.59966	7	15	92.F	76.F	45.452	0.000					0.000	855.	3.913
OCT	0.04615	1	17	85.F	68.F	10.543	0.000					0.000	2.	0.065
TOTAL	60.616						-0.044						3951.	
MAX						51.007						-7.402		3.913

EMC ENGINEERS INC. EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/ 6/1995 15: 1:52 SDL RUN 1
DENVER, CO 80227 EXISTING CONDITION OF BLDG. #7602 ADMIN & SUPP BLDG
REPORT- SS-C SYSTEM MONTHLY LOAD HOURS FOR SMALL_SZ#2 TOPEKA, KS

	NUMBER OF HOURS										COINCIDENT LOADS	
MONTH	HOURS COOLING LOAD	HOURS HEATING LOAD	HOURS COINCIDENT COOL-HEAT LOAD	HOURS FLOATING	HOURS HEATING AVAIL.	HOURS COOLING AVAIL.	HOURS FANS ON	HOURS FANS CYCLE ON	HOURS NIGHT VENTING	HOURS FLOATING WHEN FANS ON	HEATING LOAD AT COOLING PEAK (KBTU/HR)	ELECTRIC LOAD AT COOLING PEAK (KW)
MAY	273	16	0	119	24	276	408	0	0	119	0.000	3.913
JUN	639	0	0	81	0	643	720	0	0	81	0.000	3.913
JUL	735	0	0	9	0	736	744	0	0	9	0.000	3.913
AUG	731	0	0	13	0	732	744	0	0	13	0.000	3.913
SEP	459	0	0	261	0	463	720	0	0	261	0.000	3.913
OCT	6	0	0	18	0	7	24	0	0	18	0.000	0.065
ANNUAL	2843	16	0	501	24	2857	3360	0	0	501		

EMC ENGINEERS INC. EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/ 6/1995 15: 1:52 SDL RUN 1
DENVER, CO 80227 EXISTING CONDITION OF BLDG. #7602 ADMIN & SUPP BLDG
REPORT- SS-A SYSTEM MONTHLY LOADS SUMMARY FOR H&V TOPEKA, KS

MONTH	COOLING: COOLING ENERGY (MBTU)	COOLING: TIME OF MAX DY HR	COOLING: DRY-BULB TEMP	COOLING: WET-BULB TEMP	COOLING: MAXIMUM COOLING LOAD (KBTU/HR)	HEATING: HEATING ENERGY (MBTU)	HEATING: TIME OF MAX DY HR	HEATING: DRY-BULB TEMP	HEATING: WET-BULB TEMP	HEATING: MAXIMUM HEATING LOAD (KBTU/HR)	ELEC: ELEC-TRICAL ENERGY (KWH)	ELEC: MAXIMUM ELEC LOAD (KW)
MAY	0.00000				0.000	-0.015	15 23	66.F	63.F	-1.763	5930.	28.552
JUN	0.00000				0.000	0.000				0.000	10961.	28.552
JUL	0.00000				0.000	0.000				0.000	10802.	28.552
AUG	0.00000				0.000	0.000				0.000	11378.	28.552
SEP	0.00000				0.000	0.000				0.000	10770.	28.552
OCT	0.00000				0.000	0.000				0.000	225.	9.360
TOTAL	0.000					-0.015					50065.	
MAX					0.000					-1.763		28.552

EMC ENGINEERS INC. EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/ 6/1995 15: 1:52 SDL RUN 1
DENVER, CO 80227 EXISTING CONDITION OF BLDG. #7602 ADMIN & SUPP BLDG
REPORT- SS-C SYSTEM MONTHLY LOAD HOURS FOR H&V TOPEKA, KS

MONTH	HOURS COOLING LOAD	HOURS HEATING LOAD	HOURS COINCIDENT COOL-HEAT LOAD	HOURS FLOATING	HOURS HEATING AVAIL.	HOURS COOLING AVAIL.	HOURS FANS ON	HOURS FANS CYCLE ON	HOURS NIGHT VENTING	HOURS FLOATING WHEN FANS ON	COINCIDENT LOADS: HEATING LOAD AT COOLING PEAK (KBTU/HR)	COINCIDENT LOADS: ELECTRIC LOAD AT COOLING PEAK (KW)
MAY	0	12	0	396	24	0	408	0	0	396	0.000	9.360
JUN	0	0	0	720	0	0	720	0	0	720	0.000	9.360
JUL	0	0	0	744	0	0	744	0	0	744	0.000	9.360
AUG	0	0	0	744	0	0	744	0	0	744	0.000	9.360
SEP	0	0	0	720	0	0	720	0	0	720	0.000	9.360
OCT	0	0	0	24	0	0	24	0	0	24	0.000	9.360
ANNUAL	0	12	0	3348	24	0	3360	0	0	3348		

EMC ENGINEERS INC. EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/ 6/1995 15: 1:52 SDL RUN 1
DENVER, CO 80227 EXISTING CONDITION OF BLDG. #7602 ADMIN & SUPP BLDG
REPORT- SS-A SYSTEM MONTHLY LOADS SUMMARY FOR SMALL_SZ#3 TOPEKA, KS

MONTH	COOLING ENERGY (MBTU)	COOLING TIME OF MAX DY	COOLING TIME OF MAX HR	COOLING DRY-BULB TEMP	COOLING WET-BULB TEMP	MAXIMUM COOLING LOAD (KBTU/HR)	HEATING ENERGY (MBTU)	HEATING TIME OF MAX DY	HEATING TIME OF MAX HR	HEATING DRY-BULB TEMP	HEATING WET-BULB TEMP	MAXIMUM HEATING LOAD (KBTU/HR)	ELEC- TRICAL ENERGY (KWH)	MAXIMUM ELEC LOAD (KW)
MAY	3.98588	31	16	88.F	75.F	41.189	-0.049	15	6	60.F	60.F	-8.040	450.	3.913
JUN	13.00624	27	16	89.F	77.F	45.028	0.000					0.000	893.	3.913
JUL	17.45461	1	16	86.F	80.F	51.275	0.000					0.000	818.	3.913
AUG	17.79119	23	16	96.F	77.F	47.464	0.000					0.000	933.	3.913
SEP	8.56392	7	15	92.F	76.F	45.675	0.000					0.000	855.	3.913
OCT	0.04147	1	17	85.F	68.F	10.473	0.000					0.000	2.	0.065
TOTAL	60.843						-0.049						3951.	
MAX						51.275						-8.040		3.913

EMC ENGINEERS INC. EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/ 6/1995 15: 1:52 SDL RUN 1
DENVER, CO 80227 EXISTING CONDITION OF BLDG. #7602 ADMIN & SUPP BLDG
REPORT- SS-C SYSTEM MONTHLY LOAD HOURS FOR SMALL_SZ#3 TOPEKA, KS

MONTH	HOURS COOLING LOAD	HOURS HEATING LOAD	HOURS COINCIDENT COOL-HEAT LOAD	HOURS FLOATING	HOURS HEATING AVAIL.	HOURS COOLING AVAIL.	HOURS FANS ON	HOURS FANS CYCLE ON	HOURS NIGHT VENTING	HOURS FLOATING WHEN FANS ON	HEATING LOAD AT COOLING PEAK (KBTU/HR)	ELECTRIC LOAD AT COOLING PEAK (KW)
MAY	271	15	0	122	24	273	408	0	0	122	0.000	3.913
JUN	633	0	0	87	0	636	720	0	0	87	0.000	3.913
JUL	728	0	0	16	0	731	744	0	0	16	0.000	3.913
AUG	727	0	0	17	0	727	744	0	0	17	0.000	3.913
SEP	449	0	0	271	0	455	720	0	0	271	0.000	3.913
OCT	5	0	0	19	0	6	24	0	0	19	0.000	0.065
ANNUAL	2813	15	0	532	24	2828	3360	0	0	532		

EMC ENGINEERS INC. EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/ 6/1995 15: 1:52 SDL RUN 1
DENVER, CO 80227 EXISTING CONDITION OF BLDG. #7602 ADMIN & SUPP BLDG
REPORT- SS-A SYSTEM MONTHLY LOADS SUMMARY FOR SMALL_SZ#4 TOPEKA, KS

	- - - C O O L I N G - - -						- - - H E A T I N G - - -						- - - E L E C - - -	
MONTH	COOLING ENERGY (MBTU)	TIME OF MAX DY	HR	DRY-BULB TEMP	WET-BULB TEMP	MAXIMUM COOLING LOAD (KBTU/HR)	HEATING ENERGY (MBTU)	TIME OF MAX DY	HR	DRY-BULB TEMP	WET-BULB TEMP	MAXIMUM HEATING LOAD (KBTU/HR)	ELEC-TRICAL ENERGY (KWH)	MAXIMUM ELEC LOAD (KW)
MAY	3.96382	31	16	88.F	75.F	41.033	-0.044	15	6	60.F	60.F	-7.458	450.	3.913
JUN	12.85757	27	16	89.F	77.F	44.825	0.000					0.000	893.	3.913
JUL	17.14018	1	16	86.F	80.F	51.092	0.000					0.000	818.	3.913
AUG	17.51623	23	16	96.F	77.F	47.240	0.000					0.000	933.	3.913
SEP	8.53387	7	15	92.F	76.F	45.529	0.000					0.000	855.	3.913
OCT	0.04737	1	17	85.F	68.F	10.772	0.000					0.000	2.	0.065
TOTAL	60.059						-0.044						3951.	
MAX						51.092						-7.458		3.913

EMC ENGINEERS INC. EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/ 6/1995 15: 1:52 SDL RUN 1
DENVER, CO 80227 EXISTING CONDITION OF BLDG. #7602 ADMIN & SUPP BLDG
REPORT- SS-C SYSTEM MONTHLY LOAD HOURS FOR SMALL_SZ#4 TOPEKA, KS

	- - - N U M B E R O F H O U R S - - -										--COINCIDENT LOADS--	
MONTH	HOURS COOLING LOAD	HOURS HEATING LOAD	HOURS COINCIDENT COOL-HEAT LOAD	HOURS FLOATING	HOURS HEATING AVAIL.	HOURS COOLING AVAIL.	HOURS FANS ON	HOURS FANS CYCLE ON	HOURS NIGHT VENTING	HOURS FLOATING WHEN FANS ON	HEATING LOAD AT COOLING PEAK (KBTU/HR)	ELECTRIC LOAD AT COOLING PEAK (KW)
MAY	271	16	0	121	24	273	408	0	0	121	0.000	3.913
JUN	638	0	0	82	0	641	720	0	0	82	0.000	3.913
JUL	731	0	0	13	0	734	744	0	0	13	0.000	3.913
AUG	728	0	0	16	0	729	744	0	0	16	0.000	3.913
SEP	452	0	0	268	0	460	720	0	0	268	0.000	3.913
OCT	6	0	0	18	0	7	24	0	0	18	0.000	0.065
ANNUAL	2826	16	0	518	24	2844	3360	0	0	518		

EMC ENGINEERS INC. EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/ 6/1995 15: 1:52 SDL RUN 1
DENVER, CO 80227 EXISTING CONDITION OF BLDG. #7602 ADMIN & SUPP BLDG
REPORT- SS-A SYSTEM MONTHLY LOADS SUMMARY FOR SMALL_SZ#5 TOPEKA, KS

	COOLING						HEATING						ELEC	
MONTH	COOLING ENERGY (MBTU)	TIME OF MAX DY	HR	DRY-BULB TEMP	WET-BULB TEMP	MAXIMUM COOLING LOAD (KBTU/HR)	HEATING ENERGY (MBTU)	TIME OF MAX DY	HR	DRY-BULB TEMP	WET-BULB TEMP	MAXIMUM HEATING LOAD (KBTU/HR)	ELEC-TRICAL ENERGY (KWH)	MAXIMUM ELEC LOAD (KW)
MAY	3.96306	31	16	88.F	75.F	41.033	-0.044	15	6	60.F	60.F	-7.460	450.	3.913
JUN	12.85682	27	16	89.F	77.F	44.825	0.000					0.000	893.	3.913
JUL	17.14048	1	16	86.F	80.F	51.092	0.000					0.000	818.	3.913
AUG	17.51656	23	16	96.F	77.F	47.241	0.000					0.000	933.	3.913
SEP	8.53241	7	15	92.F	76.F	45.529	0.000					0.000	855.	3.913
OCT	0.04718	1	17	85.F	68.F	10.742	0.000					0.000	2.	0.065
TOTAL	60.057						-0.044						3951.	
MAX						51.092						-7.460		3.913

EMC ENGINEERS INC. EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/ 6/1995 15: 1:52 SDL RUN 1
DENVER, CO 80227 EXISTING CONDITION OF BLDG. #7602 ADMIN & SUPP BLDG
REPORT- SS-C SYSTEM MONTHLY LOAD HOURS FOR SMALL_SZ#5 TOPEKA, KS

	NUMBER OF HOURS										COINCIDENT LOADS	
MONTH	HOURS COOLING LOAD	HOURS HEATING LOAD	HOURS COINCIDENT COOL-HEAT LOAD	HOURS FLOATING	HOURS HEATING AVAIL.	HOURS COOLING AVAIL.	HOURS FANS ON	HOURS FANS CYCLE ON	HOURS NIGHT VENTING	HOURS FLOATING WHEN FANS ON	HEATING LOAD AT COOLING PEAK (KBTU/HR)	ELECTRIC LOAD AT COOLING PEAK (KW)
MAY	271	16	0	121	24	273	408	0	0	121	0.000	3.913
JUN	638	0	0	82	0	641	720	0	0	82	0.000	3.913
JUL	731	0	0	13	0	734	744	0	0	13	0.000	3.913
AUG	728	0	0	16	0	729	744	0	0	16	0.000	3.913
SEP	452	0	0	268	0	460	720	0	0	268	0.000	3.913
OCT	6	0	0	18	0	7	24	0	0	18	0.000	0.065
ANNUAL	2826	16	0	518	24	2844	3360	0	0	518		

REPORT- PS-B MONTHLY PEAK AND TOTAL ENERGY USE

MO	UTILITY-	ELECTRICITY	NATURAL-GAS
	TOTAL(MBTU)	37.245	0.350
MAY	PEAK(KBTU)	237.587	52.193
	DY/HR	31/16	15/ 6
	TOTAL(MBTU)	79.753	0.000
JUN	PEAK(KBTU)	242.281	0.000
	DY/HR	28/16	30/ 1
	TOTAL(MBTU)	85.538	0.000
JUL	PEAK(KBTU)	247.780	0.000
	DY/HR	22/16	31/ 1
	TOTAL(MBTU)	90.741	0.000
AUG	PEAK(KBTU)	250.574	0.000
	DY/HR	23/16	31/ 1
	TOTAL(MBTU)	69.670	0.000
SEP	PEAK(KBTU)	246.008	0.000
	DY/HR	7/16	30/ 1
	TOTAL(MBTU)	0.945	0.000
OCT	PEAK(KBTU)	66.308	0.000
	DY/HR	1/17	1/ 1
	ONE YEAR	363.892	0.350
	USE/PEAK	250.574	52.193

EMC ENGINEERS INC. EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/ 6/1995 15: 1:52 PDL RUN 1
DENVER, CO 80227 EXISTING CONDITION OF BLDG. #7602 ADMIN & SUPP BLDG
TOPEKA, KS

REPORT- BEPS ESTIMATED BUILDING ENERGY PERFORMANCE

ENERGY TYPE IN SITE MBTU - CATEGORY OF USE	ELECTRICITY	NATURAL-GAS
SPACE HEAT	0.01	0.35
SPACE COOL	115.77	0.00
HVAC AUX	120.82	0.00
DOM HOT WTR	0.00	0.00
AUX SOLAR	0.00	0.00
LIGHTS	113.06	0.00
VERT TRANS	0.00	0.00
MISC EQUIP	14.24	0.00
TOTAL	363.90	0.35

TOTAL SITE ENERGY 364.24 MBTU 15.5 KBTU/SQFT-YR GROSS-AREA 17.5 KBTU/SQFT-YR NET-AREA
TOTAL SOURCE ENERGY 1093.12 MBTU 46.5 KBTU/SQFT-YR GROSS-AREA 52.5 KBTU/SQFT-YR NET-AREA
PERCENT OF HOURS ANY SYSTEM ZONE OUTSIDE OF THROTTLING RANGE = 19.4
PERCENT OF HOURS ANY PLANT LOAD NOT SATISFIED = 0.0
NOTE ELECTRICITY AND/OR FUEL USED TO GENERATE ELECTRICITY IS APPORTIONED BASED ON THE YEARLY DEMAND. ALL OTHER ENERGY TYPES ARE APPORTIONED HOURLY.

EMC ENGINEERS INC. EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/ 9/1995 13:52:34 SDL RUN 1
DENVER, CO 80227 PROPOSED MODIFICATION OF BLDG. #7602 ADM. & SUPPLY BLDG
REPORT- SS-A SYSTEM MONTHLY LOADS SUMMARY FOR SMALL_SZ#1 TOPEKA, KS

MONTH	COOLING ENERGY (MBTU)	COOLING TIME OF MAX DY	COOLING TIME OF MAX HR	COOLING DRY-BULB TEMP	COOLING WET-BULB TEMP	MAXIMUM COOLING LOAD (KBTU/HR)	HEATING ENERGY (MBTU)	HEATING TIME OF MAX DY	HEATING TIME OF MAX HR	HEATING DRY-BULB TEMP	HEATING WET-BULB TEMP	MAXIMUM HEATING LOAD (KBTU/HR)	ELEC- TRICAL ENERGY (KWH)	MAXIMUM ELEC LOAD (KW)
MAY	3.65217	31	16	88.F	75.F	38.082	-0.001	15	23	66.F	63.F	-0.276	434.	3.900
JUN	10.27727	20	13	86.F	76.F	41.131	0.000					0.000	869.	3.900
JUL	12.68210	1	16	86.F	80.F	47.287	0.000					0.000	795.	3.900
AUG	13.99084	23	16	96.F	77.F	43.929	0.000					0.000	912.	3.900
SEP	7.67623	7	15	92.F	76.F	43.488	0.000					0.000	829.	3.900
OCT	0.04337	1	18	83.F	68.F	13.900	0.000					0.000	1.	0.052
TOTAL	48.322						-0.001						3840.	
MAX						47.287						-0.276		3.900

EMC ENGINEERS INC. EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/ 9/1995 13:52:34 SDL RUN 1
DENVER, CO 80227 PROPOSED MODIFICATION OF BLDG. #7602 ADM. & SUPPLY BLDG
REPORT- SS-C SYSTEM MONTHLY LOAD HOURS FOR SMALL_SZ#1 TOPEKA, KS

MONTH	HOURS COOLING LOAD	HOURS HEATING LOAD	HOURS COINCIDENT COOL-HEAT LOAD	HOURS FLOATING	HOURS HEATING AVAIL.	HOURS COOLING AVAIL.	HOURS FANS ON	HOURS FANS CYCLE ON	HOURS NIGHT VENTING	HOURS FLOATING WHEN FANS ON	HEATING LOAD AT COOLING PEAK (KBTU/HR)	ELECTRIC LOAD AT COOLING PEAK (KW)
MAY	197	4	0	207	24	384	208	208	0	7	0.000	3.900
JUN	434	0	0	286	0	720	434	434	0	0	0.000	3.900
JUL	481	0	0	263	0	744	481	481	0	0	0.000	3.900
AUG	525	0	0	219	0	744	525	525	0	0	0.000	3.900
SEP	349	0	0	371	0	656	413	413	0	64	0.000	3.900
OCT	4	0	0	20	0	13	15	15	0	11	0.000	0.052
ANNUAL	1990	4	0	1366	24	3261	2076	2076	0	82		

EMC ENGINEERS INC. EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/ 9/1995 13:52:34 SDL RUN 1
DENVER, CO 80227 PROPOSED MODIFICATION OF BLDG. #7602 ADM. & SUPPLY BLDG
REPORT- SS-A SYSTEM MONTHLY LOADS SUMMARY FOR SMALL_SZ#2 TOPEKA, KS

	COOLING						HEATING						ELEC	
MONTH	COOLING ENERGY (MBTU)	TIME OF MAX DY	HR	DRY-BULB TEMP	WET-BULB TEMP	MAXIMUM COOLING LOAD (KBTU/HR)	HEATING ENERGY (MBTU)	TIME OF MAX DY	HR	DRY-BULB TEMP	WET-BULB TEMP	MAXIMUM HEATING LOAD (KBTU/HR)	ELEC-TRICAL ENERGY (KWH)	MAXIMUM ELEC LOAD (KW)
MAY	3.68015	31	16	88.F	75.F	38.023	-0.001	15	23	66.F	63.F	-0.266	434.	3.900
JUN	10.50791	20	13	86.F	76.F	40.879	0.000					0.000	869.	3.900
JUL	13.01523	1	16	86.F	80.F	47.397	0.000					0.000	795.	3.900
AUG	14.30785	24	16	96.F	77.F	43.983	0.000					0.000	913.	3.900
SEP	7.78204	7	15	92.F	76.F	43.507	0.000					0.000	830.	3.900
OCT	0.04292	1	18	83.F	68.F	13.740	0.000					0.000	1.	0.052
TOTAL	49.336						-0.001						3842.	
MAX						47.397						-0.266		3.900

EMC ENGINEERS INC. EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/ 9/1995 13:52:34 SDL RUN 1
DENVER, CO 80227 PROPOSED MODIFICATION OF BLDG. #7602 ADM. & SUPPLY BLDG
REPORT- SS-C SYSTEM MONTHLY LOAD HOURS FOR SMALL_SZ#2 TOPEKA, KS

	NUMBER OF HOURS										COINCIDENT LOADS	
MONTH	HOURS COOLING LOAD	HOURS HEATING LOAD	HOURS COINCIDENT COOL-HEAT LOAD	HOURS FLOATING	HOURS HEATING AVAIL.	HOURS COOLING AVAIL.	HOURS FANS ON	HOURS FANS CYCLE ON	HOURS NIGHT VENTING	HOURS FLOATING WHEN FANS ON	HEATING LOAD AT COOLING PEAK (KBTU/HR)	ELECTRIC LOAD AT COOLING PEAK (KW)
MAY	198	4	0	206	24	384	209	209	0	7	0.000	3.900
JUN	441	0	0	279	0	720	441	441	0	0	0.000	3.900
JUL	488	0	0	256	0	744	488	488	0	0	0.000	3.900
AUG	533	0	0	211	0	744	533	533	0	0	0.000	3.900
SEP	355	0	0	365	0	656	419	419	0	64	0.000	3.900
OCT	4	0	0	20	0	13	15	15	0	11	0.000	0.052
ANNUAL	2019	4	0	1337	24	3261	2105	2105	0	82		

EMC ENGINEERS INC. EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/ 9/1995 13:52:34 SDL RUN 1
DENVER, CO 80227 PROPOSED MODIFICATION OF BLDG. #7602 ADM. & SUPPLY BLDG
REPORT- SS-A SYSTEM MONTHLY LOADS SUMMARY FOR H&V TOPEKA, KS

MONTH	COOLING: COOLING ENERGY (MBTU)	COOLING: TIME OF MAX DY HR	COOLING: DRY-BULB TEMP	COOLING: WET-BULB TEMP	COOLING: MAXIMUM COOLING LOAD (KBTU/HR)	HEATING: HEATING ENERGY (MBTU)	HEATING: TIME OF MAX DY HR	HEATING: DRY-BULB TEMP	HEATING: WET-BULB TEMP	HEATING: MAXIMUM HEATING LOAD (KBTU/HR)	ELEC: ELEC-TRICAL ENERGY (KWH)	ELEC: MAXIMUM ELEC LOAD (KW)
MAY	0.00000				0.000	-0.015	15 23	66.F	63.F	-1.761	5930.	28.552
JUN	0.00000				0.000	0.000				0.000	10961.	28.552
JUL	0.00000				0.000	0.000				0.000	10802.	28.552
AUG	0.00000				0.000	0.000				0.000	11378.	28.552
SEP	0.00000				0.000	0.000				0.000	10770.	28.552
OCT	0.00000				0.000	0.000				0.000	225.	9.360
TOTAL	0.000					-0.015					50065.	
MAX					0.000					-1.761		28.552

EMC ENGINEERS INC. EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/ 9/1995 13:52:34 SDL RUN 1
DENVER, CO 80227 PROPOSED MODIFICATION OF BLDG. #7602 ADM. & SUPPLY BLDG
REPORT- SS-C SYSTEM MONTHLY LOAD HOURS FOR H&V TOPEKA, KS

MONTH	NUMBER OF HOURS: HOURS COOLING LOAD	HOURS HEATING LOAD	HOURS COINCIDENT COOL-HEAT LOAD	HOURS FLOATING	HOURS HEATING AVAIL.	HOURS COOLING AVAIL.	HOURS FANS ON	HOURS FANS CYCLE ON	HOURS NIGHT VENTING	HOURS FLOATING WHEN FANS ON	COINCIDENT LOADS: HEATING LOAD AT COOLING PEAK (KBTU/HR)	COINCIDENT LOADS: ELECTRIC LOAD AT COOLING PEAK (KW)
MAY	0	12	0	396	24	0	408	0	0	396	0.000	9.360
JUN	0	0	0	720	0	0	720	0	0	720	0.000	9.360
JUL	0	0	0	744	0	0	744	0	0	744	0.000	9.360
AUG	0	0	0	744	0	0	744	0	0	744	0.000	9.360
SEP	0	0	0	720	0	0	720	0	0	720	0.000	9.360
OCT	0	0	0	24	0	0	24	0	0	24	0.000	9.360
ANNUAL	0	12	0	3348	24	0	3360	0	0	3348		

EMC ENGINEERS INC. EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/ 9/1995 13:52:34 SDL RUN 1
DENVER, CO 80227 PROPOSED MODIFICATION OF BLDG. #7602 ADM. & SUPPLY BLDG
REPORT- SS-A SYSTEM MONTHLY LOADS SUMMARY FOR SMALL_SZ#3 TOPEKA, KS

MONTH	COOLING ENERGY (MBTU)	COOLING TIME OF MAX DY	COOLING TIME OF MAX HR	COOLING DRY-BULB TEMP	COOLING WET-BULB TEMP	MAXIMUM COOLING LOAD (KBTU/HR)	HEATING ENERGY (MBTU)	HEATING TIME OF MAX DY	HEATING TIME OF MAX HR	HEATING DRY-BULB TEMP	HEATING WET-BULB TEMP	MAXIMUM HEATING LOAD (KBTU/HR)	ELECTRICAL ENERGY (KWH)	MAXIMUM ELEC LOAD (KW)
MAY	3.59803	31	16	88.F	75.F	38.223	-0.001	15	23	66.F	63.F	-0.285	434.	3.900
JUN	10.45674	20	13	86.F	76.F	41.021	0.000					0.000	869.	3.900
JUL	13.07663	1	16	86.F	80.F	47.501	0.000					0.000	795.	3.900
AUG	14.31603	24	16	96.F	77.F	44.170	0.000					0.000	913.	3.900
SEP	7.66325	6	16	93.F	76.F	43.660	0.000					0.000	830.	3.900
OCT	0.03905	1	17	85.F	68.F	14.359	0.000					0.000	1.	0.052
TOTAL	49.150						-0.001						3841.	
MAX						47.501						-0.285		3.900

EMC ENGINEERS INC. EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/ 9/1995 13:52:34 SDL RUN 1
DENVER, CO 80227 PROPOSED MODIFICATION OF BLDG. #7602 ADM. & SUPPLY BLDG
REPORT- SS-C SYSTEM MONTHLY LOAD HOURS FOR SMALL_SZ#3 TOPEKA, KS

MONTH	HOURS COOLING LOAD	HOURS HEATING LOAD	HOURS COINCIDENT COOL-HEAT LOAD	HOURS FLOATING	HOURS HEATING AVAIL.	HOURS COOLING AVAIL.	HOURS FANS ON	HOURS FANS CYCLE ON	HOURS NIGHT VENTING	HOURS FLOATING WHEN FANS ON	COINCIDENT LOADS: HEATING LOAD AT COOLING PEAK (KBTU/HR)	COINCIDENT LOADS: ELECTRIC LOAD AT COOLING PEAK (KW)
MAY	191	3	0	214	24	384	201	201	0	7	0.000	3.900
JUN	438	0	0	282	0	720	438	438	0	0	0.000	3.900
JUL	488	0	0	256	0	744	488	488	0	0	0.000	3.900
AUG	531	0	0	213	0	744	531	531	0	0	0.000	3.900
SEP	344	0	0	376	0	647	417	417	0	73	0.000	3.900
OCT	4	0	0	20	0	13	15	15	0	11	0.000	0.052
ANNUAL	1996	3	0	1361	24	3252	2090	2090	0	91		

EMC ENGINEERS INC. EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/ 9/1995 13:52:34 SDL RUN 1
DENVER, CO 80227 PROPOSED MODIFICATION OF BLDG. #7602 ADM. & SUPPLY BLDG
REPORT- SS-A SYSTEM MONTHLY LOADS SUMMARY FOR SMALL_SZ#4 TOPEKA, KS

	COOLING						HEATING						ELEC	
MONTH	COOLING ENERGY (MBTU)	TIME OF MAX DY	HR	DRY-BULB TEMP	WET-BULB TEMP	MAXIMUM COOLING LOAD (KBTU/HR)	HEATING ENERGY (MBTU)	TIME OF MAX DY	HR	DRY-BULB TEMP	WET-BULB TEMP	MAXIMUM HEATING LOAD (KBTU/HR)	ELEC-TRICAL ENERGY (KWH)	MAXIMUM ELEC LOAD (KW)
MAY	3.65819	31	16	88.F	75.F	38.071	-0.001	15	23	66.F	63.F	-0.275	434.	3.900
JUN	10.34371	20	13	86.F	76.F	41.160	0.000					0.000	869.	3.900
JUL	12.80960	1	16	86.F	80.F	47.360	0.000					0.000	795.	3.900
AUG	14.10292	24	16	96.F	77.F	43.912	0.000					0.000	912.	3.900
SEP	7.70630	7	15	92.F	76.F	43.517	0.000					0.000	830.	3.900
OCT	0.04345	1	18	83.F	68.F	13.908	0.000					0.000	1.	0.052
TOTAL	48.664						-0.001						3841.	
MAX						47.360						-0.275		3.900

EMC ENGINEERS INC. EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/ 9/1995 13:52:34 SDL RUN 1
DENVER, CO 80227 PROPOSED MODIFICATION OF BLDG. #7602 ADM. & SUPPLY BLDG
REPORT- SS-C SYSTEM MONTHLY LOAD HOURS FOR SMALL_SZ#4 TOPEKA, KS

	NUMBER OF HOURS										COINCIDENT LOADS	
MONTH	HOURS COOLING LOAD	HOURS HEATING LOAD	HOURS COINCIDENT COOL-HEAT LOAD	HOURS FLOATING	HOURS HEATING AVAIL.	HOURS COOLING AVAIL.	HOURS FANS ON	HOURS FANS CYCLE ON	HOURS NIGHT VENTING	HOURS FLOATING WHEN FANS ON	HEATING LOAD AT COOLING PEAK (KBTU/HR)	ELECTRIC LOAD AT COOLING PEAK (KW)
MAY	197	4	0	207	24	384	208	208	0	7	0.000	3.900
JUN	436	0	0	284	0	720	436	436	0	0	0.000	3.900
JUL	483	0	0	261	0	744	483	483	0	0	0.000	3.900
AUG	527	0	0	217	0	744	527	527	0	0	0.000	3.900
SEP	351	0	0	369	0	656	415	415	0	64	0.000	3.900
OCT	4	0	0	20	0	13	15	15	0	11	0.000	0.052
ANNUAL	1998	4	0	1358	24	3261	2084	2084	0	82		

REPORT- SS-A SYSTEM MONTHLY LOADS SUMMARY FOR SMALL_SZ#5 TOPEKA, KS

	COOLING						HEATING						ELEC	
MONTH	COOLING ENERGY (MBTU)	TIME OF MAX DY	HR	DRY-BULB TEMP	WET-BULB TEMP	MAXIMUM COOLING LOAD (KBTU/HR)	HEATING ENERGY (MBTU)	TIME OF MAX DY	HR	DRY-BULB TEMP	WET-BULB TEMP	MAXIMUM HEATING LOAD (KBTU/HR)	ELEC-TRICAL ENERGY (KWH)	MAXIMUM ELEC LOAD (KW)
MAY	3.65812	31	16	88.F	75.F	38.072	-0.001	15	23	66.F	63.F	-0.274	434.	3.900
JUN	10.34339	20	13	86.F	76.F	41.161	0.000					0.000	869.	3.900
JUL	12.80967	1	16	86.F	80.F	47.360	0.000					0.000	795.	3.900
AUG	14.10354	24	16	96.F	77.F	43.914	0.000					0.000	912.	3.900
SEP	7.72317	7	15	92.F	76.F	43.510	0.000					0.000	830.	3.900
OCT	0.04329	1	18	83.F	68.F	13.866	0.000					0.000	1.	0.052
TOTAL	48.681						-0.001						3841.	
MAX						47.360						-0.274		3.900

EMC ENGINEERS INC. EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/ 9/1995 13:52:34 SDL RUN 1
DENVER, CO 80227 PROPOSED MODIFICATION OF BLDG. #7602 ADM. & SUPPLY BLDG
REPORT- SS-C SYSTEM MONTHLY LOAD HOURS FOR SMALL_SZ#5 TOPEKA, KS

	NUMBER OF HOURS										COINCIDENT LOADS	
MONTH	HOURS COOLING LOAD	HOURS HEATING LOAD	HOURS COINCIDENT COOL-HEAT LOAD	HOURS FLOATING	HOURS HEATING AVAIL.	HOURS COOLING AVAIL.	HOURS FANS ON	HOURS FANS CYCLE ON	HOURS NIGHT VENTING	HOURS FLOATING WHEN FANS ON	HEATING LOAD AT COOLING PEAK (KBTU/HR)	ELECTRIC LOAD AT COOLING PEAK (KW)
MAY	197	4	0	207	24	384	208	208	0	7	0.000	3.900
JUN	436	0	0	284	0	720	436	436	0	0	0.000	3.900
JUL	483	0	0	261	0	744	483	483	0	0	0.000	3.900
AUG	527	0	0	217	0	744	527	527	0	0	0.000	3.900
SEP	352	0	0	368	0	656	416	416	0	64	0.000	3.900
OCT	4	0	0	20	0	13	15	15	0	11	0.000	0.052
ANNUAL	1999	4	0	1357	24	3261	2085	2085	0	82		

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     EMC      ENGINEERS      INC.       EZDOE - ELITE SOFTWARE DEVELOPMENT INC       DOE-2.1D   2/ 9/1995    13:52:34  PDL RUN 1
      DENVER,        CO      80227      PROPOSED MODIFICATION OF BLDG. #7602     ADM. & SUPPLY BLDG
REPORT- PS-B  MONTHLY PEAK AND TOTAL ENERGY USE                                      TOPEKA, KS
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                 MO       UTILITY-     ELECTRICITY    NATURAL-GAS
                        TOTAL(MBTU)         33.968          0.025
                 MAY     PEAK(KBTU)        213.721          3.940
                              DY/HR          31/16          15/23
                        TOTAL(MBTU)         68.887          0.000
                 JUN     PEAK(KBTU)        218.684          0.000
                              DY/HR          24/13          30/ 1
                        TOTAL(MBTU)         71.837          0.000
                 JUL     PEAK(KBTU)        228.299          0.000
                              DY/HR           1/16          31/ 1
                        TOTAL(MBTU)         76.574          0.000
                 AUG     PEAK(KBTU)        223.269          0.000
                              DY/HR          24/16          31/ 1
                        TOTAL(MBTU)         63.800          0.000
                 SEP     PEAK(KBTU)        221.616          0.000
                              DY/HR           7/16          30/ 1
                        TOTAL(MBTU)          0.946          0.000
                 OCT     PEAK(KBTU)         58.538          0.000
                              DY/HR           1/18           1/ 1

                           ONE YEAR        316.012          0.025
                           USE/PEAK        228.299          3.940
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D2-48

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     EMC      ENGINEERS      INC.       EZDOE - ELITE SOFTWARE DEVELOPMENT INC       DOE-2.1D   2/ 9/1995    13:52:34  PDL RUN 1
      DENVER,        CO      80227      PROPOSED MODIFICATION OF BLDG. #7602     ADM. & SUPPLY BLDG
REPORT- BEPS  ESTIMATED BUILDING ENERGY PERFORMANCE                                  TOPEKA, KS
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                              ENERGY TYPE
                              IN SITE MBTU -  ELECTRICITY    NATURAL-GAS
                             CATEGORY OF USE
                                SPACE HEAT          0.00           0.02
                                SPACE COOL         71.99           0.00
                                HVAC AUX          116.73           0.00
                                DOM HOT WTR         0.00           0.00
                                AUX SOLAR           0.00           0.00
                                LIGHTS            113.06           0.00
                                VERT TRANS          0.00           0.00
                                MISC EQUIP         14.24           0.00
                                              ----------     ----------
                                 TOTAL            316.01           0.02

                  TOTAL SITE ENERGY      316.04 MBTU     13.5 KBTU/SQFT-YR GROSS-AREA     15.2 KBTU/SQFT-YR NET-AREA
                  TOTAL SOURCE ENERGY    949.01 MBTU     40.4 KBTU/SQFT-YR GROSS-AREA     45.6 KBTU/SQFT-YR NET-AREA
                  PERCENT OF HOURS ANY SYSTEM ZONE OUTSIDE OF THROTTLING RANGE = 24.9
                  PERCENT OF HOURS ANY PLANT LOAD NOT SATISFIED                =  0.0
                  NOTE  ELECTRICITY AND/OR FUEL USED TO GENERATE ELECTRICITY IS APPORTIONED BASED
                        ON THE YEARLY DEMAND.  ALL OTHER ENERGY TYPES ARE APPORTIONED HOURLY.
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BUILDING 227

ANNUAL ENERGY SAVINGS SUMMARY

Item	Baseline	ECO	Annual Energy Savings	Adj. Annual Energy Savings*
Annual Electric (MBTU)	504.36	320.79	183.57	1162.89
Annual Natural Gas (MBTU)	231.80	366.27	-134.47	-851.85
Electric Demand June (KW)	32.11	27.44	4.68	29.62
Electric Demand July (KW)	34.89	30.33	4.56	28.89
Electric Demand August (KW)	33.79	29.31	4.48	28.38

*Energy savings prorated on a square foot basis:

Baseline Model Bldg 409 (sq.ft.)	5304
ECO Model Bldg 227 (sq.ft.)	33600
Square Footage Adjustment Factor	6.335

LIFE CYCLE COST ANALYSIS SUMMARY
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

LOCATION:	Fort Riley	REGION: 2 (Kansas)		PROJECT NO:	1406-005
PROJECT TITLE:	Feasibility Study for HVAC Upgrade			FISCAL YEAR:	1995
ANALYSIS DATE:	05/04/95	ECONOMIC LIFE:	20	PREPARED BY:	C. Wohlert

1. INVESTMENT: **BLDG 227 - Replace 3 SZ & 2 MZ AHUs w/ 6 VAV AHUs**

A.	CONSTRUCTION COST	=	$99,658	
B.	SIOH COST	(5.5% of 1A) =	$5,481	
C.	DESIGN COST	(6.0% of 1A) =	$5,979	
D.	TOTAL COST	(1A +1B +1C) =	$111,119	
E.	SALVAGE VALUE OF EXISTING EQUIPMENT	=	$0	
F.	PUBLIC UTILITY COMPANY REBATE	=	$0	
G.	TOTAL INVESTMENT	(1D -1E -1F) =	------->	$111,119

2. ENERGY SAVINGS (+) OR COST (-):

DATE OF NISTR 85-3273-9 USED FOR DISCOUNT FACTORS: JAN '95

	ENERGY SOURCE	FUEL COST $/MBTU (1)	SAVINGS MBTU/YR (2)	ANNUAL $ SAVINGS (3)	DISCOUNT FACTOR (4)	DISCOUNTED SAVINGS (5)	
A.	ELECT.	$12.10	1,163	$14,071	15.88	$223,447	
B.	DIST	$0.00	0	$0	19.16	$0	
C.	NAT GAS	$4.12	(852)	($3,510)	18.30	($64,226)	
D.	COAL	$0.00	0	$0	16.62	$0	
E.	ELEC. DEMAND			$1,527	14.88	$22,725	
F.	TOTAL		311	$12,089		-------->	$181,945

3. NON-ENERGY SAVINGS (+) OR COST (-)

A. ANNUAL RECURRING (+/-)

1 ANNUAL MAINTENANCE	$0	14.88	$0
2	$0	14.88	$0
3	$0	14.88	$0
4 TOTAL ANNUAL DISC. SAVINGS (+) / COST	$0		$0

B. NON-RECURRING (+/-)

ITEM	SAVINGS (+) COST(-) (1)	YEAR OF OCCURRENCE (2)	DISCOUNT FACTOR (3) (TABLE A-2)	DISCOUNTED SAVINGS/COST (4)
a. BASELINE EQUIP. REPLCMNT.	$70,248	5	0.863	$60,624
b.				$0
c.				$0
d.				$0
e.				$0
f. TOTAL	$70,248			$60,624

C. TOTAL NON-ENERGY DISCOUNTED SAVINGS (+) OR COST (-) (3A4 + 3Bf4) = $60,624

4.	FIRST YEAR DOLLAR SAVINGS (+) / COSTS (-)	(2F3+3A4+(3Bf1/Economic Life))	$15,601
5.	SIMPLE PAYBACK (SPB) IN YEARS (MUST BE < 10 YEARS TO QUALIFY)	(1G/4) =	7.12
6.	TOTAL NET DISCOUNTED SAVINGS	(2F5 + 3C) =	$242,569
7.	DISCOUNTED SAVINGS-TO-INVESTMENT RATIO (SIR) (MUST HAVE SIR > 1.25 TO QUALIFY)	(6/1G) =	2.18

ENGINEER'S OPINION OF PROBABLE COST

PROJECT	Fort Riley Feasibility Study for HVAC Upgrade	**SHEET**	1 OF 1
ENGINEER	E M C Engineers, Inc.	**DATE PREPARED**	4-May-95
	Denver, CO	**ESTIMATOR**	C. Wohlert
		CHECKED BY	A. Niemeyer

Line No.	Item Refer Code	Item Description	Unit of Measure	MATERIAL COST			LABOR COST			TOTAL
				Quantity	Unit Cost	Total	Crew/ Worker	Hours/ Unit	Total	
1		**BUILDING 227**								
2		**PROPOSED SYSTEM MODIFICATIONS**								
3										
4		*NEW SYSTEMS INSTALLATION*								
5	AHUH1300	1,300 CFM AHU	EA.	1.0	$2,296.53	$2,297	Q-5	13.9965	$271	$2,568
6	AHUH3200	3,200 CFM AHU	EA.	2.0	$3,023.28	$6,047	Q-5	21	$814	$6,861
7	AHU12000	12,000 CFM AHU, COOLING ONLY	EA.	2.0	$5,499.08	$10,998	Q-6	52.174	$2,098	$13,096
8	VSD3	VARIABLE SPEED DRIVE W/ CONTRLER,3HP	EA.	3.0	$2,238.39	$6,715	1-ELEC	10.5	$659	$7,374
9	VSD7.5	VARIABLE SPEED DRIVE W/ CONTRLER,7.5HP	EA.	2.0	$2,728.70	$5,457	1-ELEC	12.5	$523	$5,981
10	VAVBX24	VAV BOX, 2400 CFM, ELEC	EA.	13.0	$287.31	$3,735	1-SHEE	1.33	$360	$4,095
11	STLPIP2.5	STEEL PIPE SCH. 40, 2.5" W/HANGERS	L.F.	240.0	$5.28	$1,267	Q-15	0.34	$1,582	$2,850
12		VALVES AND FITTINGS ADD 15%				$190			$237	$427
13	INSLPIP2.5	2.5" FIBERGLASS PIPE INSULATION, 1.5" THCK	L.F.	240.0	$1.60	$384	Q-14	0.089	$393	$777
14	DUCT5000	GAL. STEEL DUCTWORK, 2000 TO 5000 LB.	LB.	4616.0	$0.45	$2,058	Q-10	0.087	$7,802	$9,860
15	DTINSL2"	DUCT INSLULATION, 2" THICK	S.F.	2198.0	$0.83	$1,832	Q-14	0.053	$2,145	$3,977
16	E-TSTAT1	SINGLE SETPOINT ELEC. TSTAT, 3 WIRE	EA.	13.0	$24.23	$315	1-ELEC	0.8	$218	$533
17	WIRE#12	COPPER WIRING #12	C.L.F.	6.0	$7.41	$44	1-ELEC	0.727	$91	$136
18	REHEAT2	REHEAT COIL, 2ROW, 24"x12"	EA.	8.0	$138.57	$1,109	Q-5	1.32	$205	$1,313
19	REHEAT1.5	REHEAT COIL, 2ROW, 1.5'x1'	EA.	2.0	$129.36	$259	Q-5	1.32	$51	$310
20	STLPIP0.75	STEEL PIPE SCH. 40, 0.75" W/HANGERS	L.F.	300.0	$1.51	$453	1-PLUM	0.2	$1,292	$1,746
21		VALVES AND FITTINGS ADD 15%				$68			$194	$262
22	INSLPIP0.75	0.75" FIBERGLASS PIPE INSULATION, 1" THCK	L.F.	300.0	$0.61	$183	Q-14	0.07	$387	$570
23										
24										
25		*EXISTING SYSTEMS DEMOLITION*								
26		AHU DEMOLITION	TON	2.8			Q-5	17.778	$965	$965
27		DUCT DEMOLITION	TON	2.3			Q-5	17.778	$793	$793
28		PIPING DEMOLITION 2-4"	L.F.	128.0			1-PLUM	0.053	$146	$146
29										
30										
31		**SUBTOTAL**				$43,411			$21,228	$64,639
32	OH	OVERHEAD			17%	$7,293			$3,566	$10,859
33	PRO	PROFIT			10%	$5,070			$2,479	$7,550
34	CONT	CONTINGENCY			20%	$11,155			$5,455	$16,610
35	**TOTAL COST**		-	-	-	$66,929	-	-	$32,729	$99,658

ENGINEER'S OPINION OF PROBABLE COST

PROJECT	Fort Riley Feasibility Study for HVAC Upgrade	**SHEET** 1 **OF** 1	
ENGINEER	E M C Engineers, Inc.	**DATE PREPARED**	4-May-95
	Denver, CO	**ESTIMATOR**	C. Wohlert
		CHECKED BY	A. Niemeyer

Line No.	Item Refer Code	Item Description	Unit of Measure	MATERIAL COST Quantity	MATERIAL COST Unit Cost	MATERIAL COST Total	LABOR COST Crew/ Worker	LABOR COST Hours/ Unit	LABOR COST Total	TOTAL
1		**BUILDING 227**								
2		**NON-RECURRING**								
3										
4		*NEW SYSTEMS INSTALLATION*								
5	AHUH1300	1,300 CFM AHU	EA.	1.0	$2,296.53	$2,297	Q-5	13.9965	$271	$2,568
6	AHUH3200	3,200 CFM AHU	EA.	2.0	$3,023.28	$6,047	Q-5	21	$814	$6,861
7	AHUH12000	12,000 CFM AHU	EA.	2.0	$6,598.89	$13,198	Q-6	54.7827	$2,203	$15,401
8	STLPIP2.5	STEEL PIPE SCH. 40, 2.5" W/HANGERS	L.F.	256.0	$5.28	$1,352	Q-15	0.34	$1,688	$3,040
9		VALVES AND FITTINGS ADD 15%				$203			$253	$456
10	INSLPIP2.5	2.5" FIBERGLASS PIPE INSULATION, 1.5" THCK	L.F.	256.0	$1.60	$409	Q-14	0.089	$420	$829
11	DUCT5000	GAL. STEEL DUCTWORK, 2000 TO 5000 LB.	LB.	4616.0	$0.45	$2,058	Q-10	0.087	$7,802	$9,860
12	DTINSL2"	DUCT INSLULATION, 2" THICK	S.F.	2198.0	$0.83	$1,832	Q-14	0.053	$2,145	$3,977
13	E-TSTAT1	SINGLE SETPOINT ELEC. TSTAT, 3 WIRE	EA.	13.0	$24.23	$315	1-ELEC	0.8	$218	$533
14	WIRE#12	COPPER WIRING #12	C.L.F.	6.0	$7.41	$44	1-ELEC	0.727	$91	$136
15										
16										
17										
18										
19										
20		*EXISTING SYSTEMS DEMOLITION*								
21		AHU DEMOLITION	TON	2.8			Q-5	17.778	$965	$965
22		DUCT DEMOLITION	TON	2.3			Q-5	17.778	$793	$793
23		PIPING DEMOLITION 2-4"	L.F.	128.0			1-PLUM	0.053	$146	$146
24										
25										
26										
27										
28										
29										
30										
31		**SUBTOTAL**				$27,754			$17,810	$45,563
32	OH	OVERHEAD			17%	$4,663			$2,992	$7,655
33	PRO	PROFIT			10%	$3,242			$2,080	$5,322
34	CONT	CONTINGENCY			20%	$7,132			$4,576	$11,708
35	**TOTAL COST**		-	-	-	$42,789	-	-	$27,459	$70,248

ENGINEER'S OPINION OF PROBABLE COST

PROJECT	Fort Riley Feasibility Study for HVAC Upgrade	SHEET 1 OF 1	
ENGINEER	E M C Engineers, Inc.	DATE PREPARED	4-May-95
	Denver, CO	ESTIMATOR	C. Wohlert
		CHECKED BY	A. Niemeyer

Line No.	Item Refer Code	Item Description	Unit of Measure	MATERIAL COST Quantity	Unit Cost	Total	LABOR COST Crew/ Worker	Hours/ Unit	Total	TOTAL
1		**BUILDING 227**								
2		***ANNUAL RECURRING***								
3		***ANNUAL MAINTENANCE COST - BASELINE***								
4										
5										
6										
7										
8										
9										
10										
11										
12										
13										
14										
15	**TOTAL ANNUAL MAINTENANCE COST - BASELINE**		-	-	-	$0	-	-	$0	$0
16										
17		***ANNUAL MAINTENANCE COST - NEW HVAC REPLACEMENT***								
18										
19										
20										
21										
22										
23										
24										
25										
26										
27										
28										
29	**TOTAL ANNUAL MAINTENANCE COST - BASELINE**		-	-	-	$0	-	-	$0	$0
30										
31										
32										
33										
34										
35	**TOTAL ANNUAL MAINTENANCE COST SAVINGS**		-	-	-	$0	-	-	$0	$0

DEMAND LIMITING ANALYSIS BUILDING 227

	1993	1993	1993	1993	1993	1993	1993	1993	1993	1993	1993	1993
SUMMER PEAK (KW) =	JUL BILL	AUG BILL	SEP BILL	OCT BILL	NOV BILL	DEC BILL	JAN BILL	FEB BILL	MAR BILL	APR BILL	MAY BILL	JUN BILL
27812	7/1-8/2	8/2-9/1	9/3-10/1	10/1-11/1	11/1-12/1	12/1-1/3	1/4-2/1	2/1-3/1	3/3-4/1	4/1-5/3	5/3-6/1	6/1-7/1
	ACTUAL	ACTUAL	ACTUAL	ACTUAL	ACTUAL	ACTUAL	ACTUAL	ACTUAL	ACTUAL	ACTUAL	ACTUAL	ACTUAL
BASE CASE												
CAPACITY (KW)	32472	34452	26136	20754	26400	22752	27108	25812	23310	21834	21996	30096
POWER FACTOR (%)	99.20%	99.10%	99.10%	99.90%	99.80%	99.70%	99.50%	99.60%	99.60%	99.80%	99.60%	98.80%
CAPACITY (KVA)	32734	34765	26373	20775	26453	22820	27244	25916	23404	21878	22084	30462
80% SUMMER PEAK (KVA)	27812	27812	27812	27812	27812	27812	27812	27812	27812	27812	27812	27812
CONTRACT MINIMUM (KVA)	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643
BILLING CAPACITY (KVA)	32734	34765	27812	27812	27812	27812	27812	27812	27812	27812	27812	30462
ACTUAL OR 80% PEAK	ACTUAL	ACTUAL	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	ACTUAL
200 KVA @ $4.45	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00
NEXT 400 @ $4.25	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00
REMAINING @ $4.05	$130,142.18	$138,367.78	$110,208.22	$110,208.22	$110,208.22	$110,208.22	$110,208.22	$110,208.22	$110,208.22	$110,208.22	$110,208.22	$120,939.23
SUB DISCOUNT $.20	($6,546.77)	($6,952.98)	($5,562.38)	($5,562.38)	($5,562.38)	($5,562.38)	($5,562.38)	($5,562.38)	($5,562.38)	($5,562.38)	($5,562.38)	($6,092.31)
CAPACITY CHARGE	$126,185.40	$134,004.80	$107,235.84	$107,235.84	$107,235.84	$107,235.84	$107,235.84	$107,235.84	$107,235.84	$107,235.84	$107,235.84	$117,436.92
TOTAL ENERGY (KWH)	16,920,000	16,200,000	10,980,000	10,140,000	11,160,000	12,930,000	12,600,000	12,270,000	12,480,000	11,070,000	9,720,000	13,170,000
50*KVA @ $.03924	$64,223.85	$68,208.70	$54,566.96	$54,566.96	$54,566.96	$54,566.96	$54,566.96	$54,566.96	$54,566.96	$54,566.96	$54,566.96	$59,765.54
100*KVA @ $.03404	$111,426.10	$118,339.66	$94,671.73	$94,671.73	$94,671.73	$94,671.73	$94,671.73	$94,671.73	$94,671.73	$94,671.73	$94,671.73	$103,691.08
250*KVA @ $.03084	$252,378.15	$268,037.26	$209,965.32	$184,059.72	$214,429.80	$214,429.80	$214,429.80	$214,429.80	$214,429.80	$212,740.92	$171,106.92	$234,858.46
EXCESS @ $.02864	$109,589.57	$65,701.49	$0.00	$0.00	$1,009.19	$51,701.99	$42,250.79	$32,799.59	$38,813.99	$0.00	$0.00	$28,221.42
ENERGY CHARGE	$537,617.67	$520,287.11	$359,204.01	$333,298.41	$364,677.69	$415,370.49	$405,919.29	$396,468.09	$402,482.49	$361,979.61	$320,345.61	$426,536.49
TOTAL CHARGE LESS ECA	$663,803.07	$654,291.92	$466,439.85	$440,534.25	$471,913.53	$522,606.33	$513,155.13	$503,703.93	$509,718.33	$469,215.45	$427,581.45	$543,973.42
DEMAND REDUCTION (KW)	**28.89**	**28.38**	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**29.62**
CAPACITY (KW)	32443	34424	26136	20754	26400	22752	27108	25812	23310	21834	21996	30066
POWER FACTOR (%)	99.20%	99.10%	99.10%	99.90%	99.80%	99.70%	99.50%	99.60%	99.60%	99.80%	99.60%	98.80%
CAPACITY (KVA)	32705	34736	26373	20775	26453	22820	27244	25916	23404	21878	22084	30432
80% SUMMER PEAK (KVA)	27789	27789	27789	27789	27789	27789	27789	27789	27789	27789	27789	27789
CONTRACT MINIMUM (KVA)	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643
BILLING CAPACITY (KVA)	32705	34736	27789	27789	27789	27789	27789	27789	27789	27789	27789	30432
ACTUAL OR 80% PEAK	ACTUAL	ACTUAL	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	ACTUAL
200 KVA @ $4.45	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00
NEXT 400 @ $4.25	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00
REMAINING @ $4.05	$130,024.21	$138,251.80	$110,115.44	$110,115.44	$110,115.44	$110,115.44	$110,115.44	$110,115.44	$110,115.44	$110,115.44	$110,115.44	$120,817.80
SUB DISCOUNT $.20	($6,540.95)	($6,947.25)	($5,557.80)	($5,557.80)	($5,557.80)	($5,557.80)	($5,557.80)	($5,557.80)	($5,557.80)	($5,557.80)	($5,557.80)	($6,086.31)
CAPACITY CHARGE	$126,073.27	$133,894.55	$107,147.64	$107,147.64	$107,147.64	$107,147.64	$107,147.64	$107,147.64	$107,147.64	$107,147.64	$107,147.64	$117,321.49
TOTAL ENERGY (KWH)	16,920,000	16,200,000	10,980,000	10,140,000	11,160,000	12,930,000	12,600,000	12,270,000	12,480,000	11,070,000	9,720,000	13,170,000
50*KVA @ $.03924	$64,166.71	$68,152.52	$54,522.01	$54,522.01	$54,522.01	$54,522.01	$54,522.01	$54,522.01	$54,522.01	$54,522.01	$54,522.01	$59,706.71
100*KVA @ $.03404	$111,326.95	$118,242.18	$94,593.75	$94,593.75	$94,593.75	$94,593.75	$94,593.75	$94,593.75	$94,593.75	$94,593.75	$94,593.75	$103,589.01
250*KVA @ $.03084	$252,153.58	$267,816.46	$210,071.30	$184,165.70	$214,253.17	$214,253.17	$214,253.17	$214,253.17	$214,253.17	$212,846.90	$171,212.90	$234,627.29
EXCESS @ $.02864	$109,923.25	$66,029.56	$0.00	$0.00	$1,271.65	$51,964.45	$42,513.25	$33,062.05	$39,076.45	$0.00	$0.00	$28,564.90
ENERGY CHARGE	$537,570.49	$520,240.72	$359,187.06	$333,281.46	$364,640.58	$415,333.38	$405,882.18	$396,430.98	$402,445.38	$361,962.66	$320,328.66	$426,487.92
TOTAL CHARGE LESS ECA	$663,643.75	$654,135.27	$466,334.70	$440,429.10	$471,788.22	$522,481.02	$513,029.82	$503,578.62	$509,593.02	$469,110.30	$427,476.30	$543,809.41
SUMMARY												
MONTHLY DIFFERENCE	$159.32	$156.65	$105.16	$105.16	$125.32	$125.32	$125.32	$125.32	$125.32	$105.16	$105.16	$164.01
ANNUAL DIFFERENCE.............		**$1,527.19**										

EMC ENGINEERS INC. EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/27/1995 16:58:36 LDL RUN 1
DENVER, CO 80227 EXISTING CONDITION OF BLDG 227 ENL BARRACKS W/AS
REPORT- LV-D DETAILS OF EXTERIOR SURFACES IN THE PROJECT TOPEKA, KS

NUMBER OF EXTERIOR SURFACES 12 RECTANGULAR 12 OTHER 0
(U-VALUE INCLUDES INSIDE AIR FILM PLUS OUTSIDE AIR FILM AT 7.5 MPH WINDSPEED)

SURFACE	SPACE	GLASS U-VALUE (BTU/HR-SQFT-F)	GLASS AREA (SQFT)	WALL U-VALUE (BTU/HR-SQFT-F)	WALL AREA (SQFT)	WALL+GLASS U-VALUE (BTU/HR-SQFT-F)	WALL+GLASS AREA (SQFT)	AZIMUTH
	NE_ROOMS	0.490	364.00	0.231	1612.00	0.278	1976.00	NORTH-EAST
	TV/POOL_RM	0.490	36.00	0.231	164.00	0.277	200.00	NORTH-EAST
	BASE_HALL	0.490	10.50	0.231	29.50	0.299	40.00	NORTH-EAST
	BASE_HALL	0.000	0.00	0.231	68.00	0.231	68.00	SOUTH-EAST
	TV/POOL_RM	0.490	72.00	0.231	203.00	0.299	275.00	SOUTH-EAST
	SW_ROOMS	0.490	364.00	0.231	1612.00	0.278	1976.00	SOUTH-WEST
	BASE_HALL	0.490	21.00	0.231	71.00	0.290	92.00	SOUTH-WEST
	SW_ROOMS	0.490	56.00	0.231	334.00	0.268	390.00	NORTH-WEST
	TV/POOL_RM	0.490	72.00	0.231	203.00	0.299	275.00	NORTH-WEST
	NE_ROOMS	0.490	56.00	0.231	334.00	0.268	390.00	NORTH-WEST
	SW_ROOMS	0.000	0.00	0.041	1140.00	0.041	1140.00	ROOF
	NE_ROOMS	0.000	0.00	0.041	1140.00	0.041	1140.00	ROOF
	TV/POOL_RM	0.000	0.00	0.020	1360.00	0.020	1360.00	UNDERGRND
	TV/POOL_RM	0.000	0.00	0.020	2200.00	0.020	2200.00	UNDERGRND
	BASE_HALL	0.000	0.00	0.020	207.00	0.020	207.00	UNDERGRND
	BASE_HALL	0.000	0.00	0.020	153.00	0.020	153.00	UNDERGRND
	BASE_HALL	0.000	0.00	0.020	90.00	0.020	90.00	UNDERGRND
	BASE_HALL	0.000	0.00	0.020	824.00	0.020	824.00	UNDERGRND

D3.7

EMC ENGINEERS INC. EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/27/1995 16:58:36 LDL RUN 1
DENVER, CO 80227 EXISTING CONDITION OF BLDG 227 ENL BARRACKS W/AS
REPORT- LV-D DETAILS OF EXTERIOR SURFACES IN THE PROJECT TOPEKA, KS

	AVERAGE U-VALUE/GLASS (BTU/HR-SQFT-F)	AVERAGE U-VALUE/WALLS (BTU/HR-SQFT-F)	AVERAGE U-VALUE WALLS+GLASS (BTU/HR-SQFT-F)	GLASS AREA (SQFT)	OPAQUE AREA (SQFT)	GLASS+OPAQUE AREA (SQFT)
NORTH-EAST	0.490	0.231	0.279	410.50	1805.50	2216.00
SOUTH-EAST	0.490	0.231	0.285	72.00	271.00	343.00
SOUTH-WEST	0.490	0.231	0.279	385.00	1683.00	2068.00
NORTH-WEST	0.490	0.231	0.276	184.00	871.00	1055.00
ROOF	0.000	0.041	0.041	0.00	2280.00	2280.00
ALL WALLS	0.490	0.231	0.279	1051.50	4630.50	5682.00
WALLS+ROOFS	0.490	0.168	0.210	1051.50	6910.50	7962.00
UNDERGRND	0.000	0.020	0.020	0.00	4834.00	4834.00
BUILDING	0.490	0.107	0.139	1051.50	11744.50	12796.00

```
*** BUILDING ***

                     FLOOR  AREA      5304  SQFT       493  SQMT
                     VOLUME          98592  CUFT      2792  CUMT

                                          COOLING  LOAD                                  HEATING  LOAD
                                      =====================                          =====================
                TIME                      JUL 23  5PM                                    JAN 28  5AM
                DRY-BULB TEMP              97F    36C                                     -1F    -18C
                WET-BULB TEMP              79F    26C                                     -2F    -19C

                                   SENSIBLE            LATENT                               SENSIBLE
                              (KBTU/H)   ( KW )  (KBTU/H)  ( KW )                      (KBTU/H)  ( KW )
                              --------   ------  --------  ------                      --------  --------
    WALLS                       12.782    3.743     0.000   0.000                       -66.921   -19.600
    ROOFS                        5.103    1.494     0.000   0.000                        -6.980    -2.044
    GLASS CONDUCTION            11.154    3.267     0.000   0.000                       -39.924   -11.693
    GLASS SOLAR                 26.039    7.626     0.000   0.000                         1.066     0.312
    DOOR                         0.107    0.031     0.000   0.000                        -0.325    -0.095
    INTERNAL SURFACES            0.000    0.000     0.000   0.000                         0.000     0.000
    UNDERGROUND SURFACES        -0.868   -0.254     0.000   0.000                        -2.776    -0.813
    OCCUPANTS TO SPACE          13.681    4.007    23.125   6.773                        11.980     3.509
    LIGHT     TO SPACE          16.782    4.915     0.000   0.000                         4.737     1.387
    EQUIPMENT TO SPACE          10.145    2.971     0.000   0.000                         2.220     0.650
    PROCESS   TO SPACE           0.000    0.000     0.000   0.000                         0.000     0.000
    INFILTRATION                 0.000    0.000     0.000   0.000                         0.000     0.000
                              --------  -------   -------  ------                      --------  --------
    TOTAL                       94.924   27.801    23.125   6.773                       -96.924   -28.387
    TOTAL LOAD                 118.049 KBTU/H      34.573  KW                  -96.924 KBTU/H     -28.387  KW
    TOTAL LOAD / AREA           22.26BTU/H.SQFT    70.163  W /SQMT             18.274BTU/H.SQFT    57.608  W /SQMT

                     ****************************************************************
                     *                                                              *
                     *  NOTE  1)THE ABOVE LOADS EXCLUDE OUTSIDE VENTILATION AIR     *
                     *  ----    LOADS                                               *
                     *        2)TIMES GIVEN IN STANDARD TIME FOR THE LOCATION       *
                     *          IN CONSIDERATION                                    *
                     *                                                              *
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REPORT- SS-A SYSTEM MONTHLY LOADS SUMMARY FOR MZ-ZN_1&2 TOPEKA, KS

MONTH	COOLING ENERGY (MBTU)	COOLING TIME OF MAX DY	COOLING TIME OF MAX HR	COOLING DRY-BULB TEMP	COOLING WET-BULB TEMP	MAXIMUM COOLING LOAD (KBTU/HR)	HEATING ENERGY (MBTU)	HEATING TIME OF MAX DY	HEATING TIME OF MAX HR	HEATING DRY-BULB TEMP	HEATING WET-BULB TEMP	MAXIMUM HEATING LOAD (KBTU/HR)	ELEC-TRICAL ENERGY (KWH)	MAXIMUM ELEC LOAD (KW)
JAN	0.00000					0.000	-37.710	15	7	-7.F	-8.F	-111.808	6908.	11.194
FEB	0.00000					0.000	-24.628	3	5	-1.F	-2.F	-93.433	6240.	11.194
MAR	0.00000					0.000	-13.823	4	5	14.F	12.F	-71.208	6911.	11.194
APR	0.00000					0.000	-1.694	1	1	32.F	29.F	-38.276	6687.	11.194
MAY	25.16875	16	2	62.F	59.F	138.830	-0.340	10	23	60.F	56.F	-4.452	6908.	11.194
JUN	57.15411	27	17	89.F	77.F	130.129	0.000					0.000	6688.	11.194
JUL	68.56995	23	17	97.F	79.F	138.904	0.000					0.000	6907.	11.194
AUG	65.85425	22	17	95.F	77.F	132.974	0.000					0.000	6911.	11.194
SEP	39.90973	7	17	92.F	75.F	120.236	0.000					0.000	6687.	11.194
OCT	0.76531	1	18	83.F	68.F	71.765	-1.433	20	8	23.F	22.F	-39.196	6907.	11.194
NOV	0.00000					0.000	-11.969	3	5	13.F	12.F	-67.629	6685.	11.194
DEC	0.00000					0.000	-32.383	15	2	3.F	2.F	-96.613	6908.	11.194
TOTAL	257.422						-123.976						81351.	
MAX						138.904						-111.808		11.194

D3-9

EMC ENGINEERS INC. EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/27/1995 16:58:36 SDL RUN 1
DENVER, CO 80227 EXISTING CONDITION OF BLDG 227 ENL BARRACKS W/AS
REPORT- SS-C SYSTEM MONTHLY LOAD HOURS FOR MZ-ZN_1&2 TOPEKA, KS

MONTH	HOURS COOLING LOAD	HOURS HEATING LOAD	HOURS COINCIDENT COOL-HEAT LOAD	HOURS FLOATING	HOURS HEATING AVAIL.	HOURS COOLING AVAIL.	HOURS FANS ON	HOURS FANS CYCLE ON	HOURS NIGHT VENTING	HOURS FLOATING WHEN FANS ON	COINCIDENT LOADS HEATING LOAD AT COOLING PEAK (KBTU/HR)	COINCIDENT LOADS ELECTRIC LOAD AT COOLING PEAK (KW)
JAN	0	744	0	0	744	0	744	0	0	0	-43.792	5.963
FEB	0	672	0	0	672	0	672	0	0	0	-40.028	5.963
MAR	0	744	0	0	744	0	744	0	0	0	-37.093	5.963
APR	0	720	0	0	720	0	720	0	0	0	-4.472	5.963
MAY	384	360	0	0	360	384	744	0	0	0	0.000	5.963
JUN	720	0	0	0	0	720	720	0	0	0	0.000	11.194
JUL	744	0	0	0	0	744	744	0	0	0	0.000	11.194
AUG	744	0	0	0	0	744	744	0	0	0	0.000	11.194
SEP	713	0	0	7	0	720	720	0	0	7	0.000	11.194
OCT	16	720	0	8	720	24	744	0	0	8	0.000	11.194
NOV	0	720	0	0	720	0	720	0	0	0	-48.048	5.963
DEC	0	744	0	0	744	0	744	0	0	0	-53.434	8.288
ANNUAL	3321	5424	0	15	5424	3336	8760	0	0	15		

EMC ENGINEERS INC. EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/27/1995 16:58:36 SDL RUN 1
DENVER, CO 80227 EXISTING CONDITION OF BLDG 227 ENL BARRACKS W/AS
REPORT- SS-A SYSTEM MONTHLY LOADS SUMMARY FOR MZ-ZN_3&4 TOPEKA, KS

MONTH	COOLING: COOLING ENERGY (MBTU)	COOLING: TIME OF MAX DY	COOLING: TIME OF MAX HR	COOLING: DRY-BULB TEMP	COOLING: WET-BULB TEMP	COOLING: MAXIMUM COOLING LOAD (KBTU/HR)	HEATING: HEATING ENERGY (MBTU)	HEATING: TIME OF MAX DY	HEATING: TIME OF MAX HR	HEATING: DRY-BULB TEMP	HEATING: WET-BULB TEMP	HEATING: MAXIMUM HEATING LOAD (KBTU/HR)	ELEC: ELEC-TRICAL ENERGY (KWH)	ELEC: MAXIMUM ELEC LOAD (KW)
JAN	0.00000					0.000	-7.298	15	6	-8.F	-9.F	-28.440	2750.	4.665
FEB	0.00000					0.000	-4.709	3	5	-1.F	-2.F	-25.106	2484.	4.665
MAR	0.00000					0.000	-2.175	4	5	14.F	12.F	-19.573	2752.	4.665
APR	0.00000					0.000	-0.126	1	3	36.F	32.F	-10.550	2662.	4.665
MAY	7.74145	16	2	62.F	59.F	58.441	-0.031	8	1	50.F	48.F	-0.660	2750.	4.665
JUN	15.96486	19	17	87.F	76.F	41.617	0.000					0.000	2663.	4.665
JUL	19.50407	23	18	95.F	79.F	45.493	0.000					0.000	2749.	4.665
AUG	18.88764	21	17	95.F	77.F	44.093	0.000					0.000	2752.	4.665
SEP	12.93794	5	18	90.F	77.F	41.694	0.000					0.000	2662.	4.665
OCT	0.36114	1	18	83.F	68.F	28.462	-0.096	2	2	64.F	59.F	-8.086	2749.	4.665
NOV	0.00000					0.000	-0.776	3	5	13.F	12.F	-13.420	2661.	4.665
DEC	0.00000					0.000	-5.595	15	3	4.F	3.F	-23.745	2750.	4.665
TOTAL	75.397						-20.806						32384.	
MAX						58.441						-28.440		4.665

EMC ENGINEERS INC. EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/27/1995 16:58:36 SDL RUN 1
DENVER, CO 80227 EXISTING CONDITION OF BLDG 227 ENL BARRACKS W/AS
REPORT- SS-C SYSTEM MONTHLY LOAD HOURS FOR MZ-ZN_3&4 TOPEKA, KS

MONTH	HOURS COOLING LOAD	HOURS HEATING LOAD	HOURS COINCIDENT COOL-HEAT LOAD	HOURS FLOATING	HOURS HEATING AVAIL.	HOURS COOLING AVAIL.	HOURS FANS ON	HOURS FANS CYCLE ON	HOURS NIGHT VENTING	HOURS FLOATING WHEN FANS ON	COINCIDENT LOADS: HEATING LOAD AT COOLING PEAK (KBTU/HR)	COINCIDENT LOADS: ELECTRIC LOAD AT COOLING PEAK (KW)
JAN	0	744	0	0	744	0	744	0	0	0	-11.095	2.011
FEB	0	672	0	0	672	0	672	0	0	0	-9.675	2.011
MAR	0	744	0	0	744	0	744	0	0	0	-9.696	2.011
APR	0	720	0	0	720	0	720	0	0	0	-0.784	2.011
MAY	384	360	0	0	360	384	744	0	0	0	0.000	2.011
JUN	720	0	0	0	0	720	720	0	0	0	0.000	4.665
JUL	744	0	0	0	0	744	744	0	0	0	0.000	4.665
AUG	744	0	0	0	0	744	744	0	0	0	0.000	4.665
SEP	717	0	0	3	0	720	720	0	0	3	0.000	4.665
OCT	17	720	0	7	720	24	744	0	0	7	0.000	4.665
NOV	0	720	0	0	720	0	720	0	0	0	-10.548	2.011
DEC	0	744	0	0	744	0	744	0	0	0	-6.905	3.190
ANNUAL	3326	5424	0	10	5424	3336	8760	0	0	10		

MO	UTILITY-	ELECTRICITY	NATURAL-GAS
	TOTAL(MBTU)	35.097	67.345
JAN	PEAK(KBTU)	57.257	183.575
	DY/HR	31/13	15/ 6
	TOTAL(MBTU)	31.528	46.392
FEB	PEAK(KBTU)	57.257	160.067
	DY/HR	28/10	3/ 5
	TOTAL(MBTU)	34.121	26.932
MAR	PEAK(KBTU)	57.257	128.400
	DY/HR	31/10	4/ 5
	TOTAL(MBTU)	32.164	4.776
APR	PEAK(KBTU)	56.339	78.284
	DY/HR	5/ 8	1/ 1
	TOTAL(MBTU)	43.394	1.485
MAY	PEAK(KBTU)	109.601	10.893
	DY/HR	31/18	10/23
	TOTAL(MBTU)	55.226	0.000
JUN	PEAK(KBTU)	109.598	0.000
	DY/HR	27/19	30/ 1
	TOTAL(MBTU)	61.142	0.000
JUL	PEAK(KBTU)	119.085	0.000
	DY/HR	23/16	31/ 1
	TOTAL(MBTU)	61.185	0.000
AUG	PEAK(KBTU)	115.330	0.000
	DY/HR	21/17	31/ 1
	TOTAL(MBTU)	49.030	0.000
SEP	PEAK(KBTU)	109.246	0.000
	DY/HR	5/18	30/ 1
	TOTAL(MBTU)	33.567	4.301
OCT	PEAK(KBTU)	92.598	66.586
	DY/HR	1/17	20/ 8
	TOTAL(MBTU)	32.917	22.266
NOV	PEAK(KBTU)	57.257	117.032
	DY/HR	30/20	3/ 5
	TOTAL(MBTU)	34.970	58.297
DEC	PEAK(KBTU)	57.257	161.984
	DY/HR	31/22	15/ 2
	ONE YEAR	504.340	231.796
	USE/PEAK	119.085	183.575

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    EMC      ENGINEERS      INC.      EZDOE - ELITE SOFTWARE DEVELOPMENT INC       DOE-2.1D   2/27/1995    16:58:36  PDL RUN 1
   DENVER,      CO         80227      EXISTING CONDITION OF BLDG 227          ENL BARRACKS W/AS
REPORT- BEPS  ESTIMATED BUILDING ENERGY PERFORMANCE                                  TOPEKA, KS
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                               ENERGY TYPE
                               IN SITE MBTU -  ELECTRICITY     NATURAL-GAS
                              CATEGORY OF USE
                                 SPACE HEAT        8.52          231.80
                                 SPACE COOL      107.48            0.00
                                 HVAC AUX        212.29            0.00
                                 DOM HOT WTR       0.00            0.00
                                 AUX SOLAR         0.00            0.00
                                 LIGHTS          111.39            0.00
                                 VERT TRANS        0.00            0.00
                                 MISC EQUIP       64.67            0.00
                                               ----------      ----------
                                  TOTAL          504.36          231.80

                    TOTAL SITE ENERGY       736.14 MBTU    138.8 KBTU/SQFT-YR GROSS-AREA    138.8 KBTU/SQFT-YR NET-AREA
                    TOTAL SOURCE ENERGY    1746.33 MBTU    329.2 KBTU/SQFT-YR GROSS-AREA    329.2 KBTU/SQFT-YR NET-AREA
                    PERCENT OF HOURS ANY SYSTEM ZONE OUTSIDE OF THROTTLING RANGE =  0.2
                    PERCENT OF HOURS ANY PLANT LOAD NOT SATISFIED                =  0.0
                    NOTE  ELECTRICITY AND/OR FUEL USED TO GENERATE ELECTRICITY IS APPORTIONED BASED
                          ON THE YEARLY DEMAND.  ALL OTHER ENERGY TYPES ARE APPORTIONED HOURLY.
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EMC ENGINEERS INC. EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/22/1995 13:56:41 SDL RUN 1
DENVER, CO 80227 PROPOSED MODIFICATION OF BLDG 227 ENL BARRACKS W/AS
REPORT- SS-A SYSTEM MONTHLY LOADS SUMMARY FOR MZ-ZN_1&2 TOPEKA, KS

	COOLING						HEATING						ELEC	
MONTH	COOLING ENERGY (MBTU)	TIME OF MAX DY	HR	DRY-BULB TEMP	WET-BULB TEMP	MAXIMUM COOLING LOAD (KBTU/HR)	HEATING ENERGY (MBTU)	TIME OF MAX DY	HR	DRY-BULB TEMP	WET-BULB TEMP	MAXIMUM HEATING LOAD (KBTU/HR)	ELEC-TRICAL ENERGY (KWH)	MAXIMUM ELEC LOAD (KW)
JAN	0.00000					0.000	-50.464	15	6	-8.F	-9.F	-118.452	3133.	6.120
FEB	0.00000					0.000	-36.382	3	7	-5.F	-6.F	-108.924	2830.	6.210
MAR	0.00000					0.000	-25.838	4	5	14.F	12.F	-87.581	3241.	12.472
APR	0.00000					0.000	-6.608	1	1	32.F	29.F	-54.839	4418.	12.472
MAY	19.09696	16	2	62.F	59.F	117.078	-1.569	5	5	44.F	40.F	-21.968	4455.	12.472
JUN	46.86300	27	17	89.F	77.F	122.298	0.000					0.000	3698.	8.829
JUL	58.90392	23	17	97.F	79.F	132.554	0.000					0.000	4012.	9.141
AUG	56.16653	22	17	95.F	77.F	126.116	0.000					0.000	3980.	9.060
SEP	29.43439	7	18	91.F	74.F	111.677	0.000					0.000	3318.	8.548
OCT	0.47590	1	17	85.F	68.F	36.310	-6.471	20	8	23.F	22.F	-57.401	4313.	12.472
NOV	0.00000					0.000	-22.511	3	5	13.F	12.F	-84.139	3239.	12.472
DEC	0.00000					0.000	-45.281	13	8	0.F	-1.F	-110.495	3133.	6.120
TOTAL	210.941						-195.124						43771.	
MAX						132.554						-118.452		12.472

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EMC ENGINEERS INC. EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/22/1995 13:56:41 SDL RUN 1
DENVER, CO 80227 PROPOSED MODIFICATION OF BLDG 227 ENL BARRACKS W/AS
REPORT- SS-C SYSTEM MONTHLY LOAD HOURS FOR MZ-ZN_1&2 TOPEKA, KS

	NUMBER OF HOURS										COINCIDENT LOADS	
MONTH	HOURS COOLING LOAD	HOURS HEATING LOAD	HOURS COINCIDENT COOL-HEAT LOAD	HOURS FLOATING	HOURS HEATING AVAIL.	HOURS COOLING AVAIL.	HOURS FANS ON	HOURS FANS CYCLE ON	HOURS NIGHT VENTING	HOURS FLOATING WHEN FANS ON	HEATING LOAD AT COOLING PEAK (KBTU/HR)	ELECTRIC LOAD AT COOLING PEAK (KW)
JAN	0	744	0	0	744	0	744	0	0	0	-60.297	0.888
FEB	0	672	0	0	672	0	672	0	0	0	-56.888	0.888
MAR	0	707	0	37	744	0	744	0	0	37	-53.800	0.888
APR	0	430	0	290	720	0	720	0	0	290	-9.924	3.105
MAY	384	153	0	207	360	384	744	0	0	207	0.000	6.937
JUN	720	0	0	0	0	720	720	0	0	0	0.000	8.738
JUL	744	0	0	0	0	744	744	0	0	0	0.000	9.141
AUG	744	0	0	0	0	744	744	0	0	0	0.000	8.958
SEP	720	0	0	0	0	720	720	0	0	0	0.000	8.548
OCT	24	442	0	278	720	24	744	0	0	278	0.000	6.120
NOV	0	655	0	65	720	0	720	0	0	65	-64.398	0.888
DEC	0	744	0	0	744	0	744	0	0	0	-70.345	3.213
ANNUAL	3336	4547	0	877	5424	3336	8760	0	0	877		

EMC ENGINEERS INC. 　EZDOE - ELITE SOFTWARE DEVELOPMENT INC 　DOE-2.1D 　2/22/1995 　13:56:41 　SDL RUN 1
DENVER, CO 80227 　PROPOSED MODIFICATION OF BLDG 227 　ENL BARRACKS W/AS
REPORT- SS-A SYSTEM MONTHLY LOADS SUMMARY FOR 　MZ-ZN_3&4 　TOPEKA, KS

MONTH	COOLING: COOLING ENERGY (MBTU)	COOLING: TIME OF MAX DY	COOLING: TIME OF MAX HR	COOLING: DRY-BULB TEMP	COOLING: WET-BULB TEMP	COOLING: MAXIMUM COOLING LOAD (KBTU/HR)	HEATING: HEATING ENERGY (MBTU)	HEATING: TIME OF MAX DY	HEATING: TIME OF MAX HR	HEATING: DRY-BULB TEMP	HEATING: WET-BULB TEMP	HEATING: MAXIMUM HEATING LOAD (KBTU/HR)	ELEC: ELEC-TRICAL ENERGY (KWH)	ELEC: MAXIMUM ELEC LOAD (KW)
JAN	0.00000					0.000	-11.552	15	6	-8.F	-9.F	-32.801	1546.	3.047
FEB	0.00000					0.000	-8.524	3	5	-1.F	-2.F	-29.345	1397.	3.080
MAR	0.00000					0.000	-6.068	4	5	14.F	12.F	-23.682	1572.	4.437
APR	0.00000					0.000	-1.477	1	3	36.F	32.F	-14.840	1901.	5.072
MAY	5.58373	16	2	62.F	59.F	62.908	-0.432	1	2	44.F	41.F	-6.238	1915.	5.072
JUN	12.64975	27	19	88.F	76.F	36.777	0.000					0.000	1636.	3.675
JUL	16.33679	23	18	95.F	79.F	41.017	0.000					0.000	1750.	3.793
AUG	15.86384	21	17	95.F	77.F	39.785	0.000					0.000	1755.	3.817
SEP	9.47309	5	18	90.F	77.F	36.658	0.000					0.000	1587.	3.638
OCT	0.17250	1	17	85.F	68.F	11.907	-1.177	2	2	64.F	59.F	-17.650	2032.	5.072
NOV	0.00000					0.000	-4.130	3	5	13.F	12.F	-21.234	1589.	5.072
DEC	0.00000					0.000	-9.836	15	3	4.F	3.F	-28.142	1546.	3.047
TOTAL	60.080						-43.196						20227.	
MAX						62.908						-32.801		5.072

D3-14

EMC ENGINEERS INC. 　EZDOE - ELITE SOFTWARE DEVELOPMENT INC 　DOE-2.1D 　2/22/1995 　13:56:41 　SDL RUN 1
DENVER, CO 80227 　PROPOSED MODIFICATION OF BLDG 227 　ENL BARRACKS W/AS
REPORT- SS-C SYSTEM MONTHLY LOAD HOURS FOR 　MZ-ZN_3&4 　TOPEKA, KS

MONTH	NUMBER OF HOURS: HOURS COOLING LOAD	HOURS HEATING LOAD	HOURS COINCIDENT COOL-HEAT LOAD	HOURS FLOATING	HOURS HEATING AVAIL.	HOURS COOLING AVAIL.	HOURS FANS ON	HOURS FANS CYCLE ON	HOURS NIGHT VENTING	HOURS FLOATING WHEN FANS ON	COINCIDENT LOADS: HEATING LOAD AT COOLING PEAK (KBTU/HR)	COINCIDENT LOADS: ELECTRIC LOAD AT COOLING PEAK (KW)
JAN	0	744	0	0	744	0	744	0	0	0	-15.264	0.393
FEB	0	672	0	0	672	0	672	0	0	0	-14.521	0.393
MAR	0	712	0	32	744	0	744	0	0	32	-14.081	0.393
APR	0	410	0	310	720	0	720	0	0	310	0.000	2.418
MAY	384	162	0	198	360	384	744	0	0	198	0.000	2.418
JUN	720	0	0	0	0	720	720	0	0	0	0.000	3.661
JUL	744	0	0	0	0	744	744	0	0	0	0.000	3.784
AUG	744	0	0	0	0	744	744	0	0	0	0.000	3.790
SEP	720	0	0	0	0	720	720	0	0	0	0.000	3.629
OCT	24	360	0	360	720	24	744	0	0	360	0.000	3.047
NOV	0	597	0	123	720	0	720	0	0	123	-15.050	0.393
DEC	0	744	0	0	744	0	744	0	0	0	-12.715	1.572
ANNUAL	3336	4401	0	1023	5424	3336	8760	0	0	1023		

MO	UTILITY-	ELECTRICITY	NATURAL-GAS
	TOTAL(MBTU)	18.462	89.869
JAN	PEAK(KBTU)	34.658	198.595
	DY/HR	31/20	15/ 6
	TOTAL(MBTU)	16.624	67.815
FEB	PEAK(KBTU)	34.658	183.873
	DY/HR	28/20	3/ 5
	TOTAL(MBTU)	18.385	50.859
MAR	PEAK(KBTU)	55.517	153.948
	DY/HR	12/14	4/ 5
	TOTAL(MBTU)	22.287	14.780
APR	PEAK(KBTU)	60.155	105.059
	DY/HR	3/22	1/ 1
	TOTAL(MBTU)	30.111	4.011
MAY	PEAK(KBTU)	92.125	43.720
	DY/HR	31/18	6/ 5
	TOTAL(MBTU)	37.593	0.000
JUN	PEAK(KBTU)	93.638	0.000
	DY/HR	27/19	30/ 1
	TOTAL(MBTU)	43.966	0.000
JUL	PEAK(KBTU)	103.518	0.000
	DY/HR	23/16	31/ 1
	TOTAL(MBTU)	43.913	0.000
AUG	PEAK(KBTU)	100.040	0.000
	DY/HR	21/17	31/ 1
	TOTAL(MBTU)	30.184	0.000
SEP	PEAK(KBTU)	91.658	0.000
	DY/HR	7/18	30/ 1
	TOTAL(MBTU)	22.638	14.242
OCT	PEAK(KBTU)	59.903	105.067
	DY/HR	13/10	20/ 5
	TOTAL(MBTU)	18.194	43.090
NOV	PEAK(KBTU)	59.761	147.190
	DY/HR	23/14	3/ 5
	TOTAL(MBTU)	18.433	81.603
DEC	PEAK(KBTU)	34.658	182.819
	DY/HR	31/22	15/ 2
	ONE YEAR	320.790	366.270
	USE/PEAK	103.518	198.595

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EMC         ENGINEERS      INC.        EZDOE - ELITE SOFTWARE DEVELOPMENT INC        DOE-2.1D   2/22/1995    13:56:41  PDL RUN 1
  DENVER,       CO         80227       PROPOSED MODIFICATION OF BLDG 227        ENL BARRACKS W/AS
REPORT- BEPS  ESTIMATED BUILDING ENERGY PERFORMANCE                                   TOPEKA, KS
```

ENERGY TYPE IN SITE MBTU - CATEGORY OF USE	ELECTRICITY	NATURAL-GAS
SPACE HEAT	12.42	366.27
SPACE COOL	89.86	0.00
HVAC AUX	42.46	0.00
DOM HOT WTR	0.00	0.00
AUX SOLAR	0.00	0.00
LIGHTS	111.39	0.00
VERT TRANS	0.00	0.00
MISC EQUIP	64.67	0.00
TOTAL	320.79	366.27

```
TOTAL SITE ENERGY        687.06 MBTU    129.5 KBTU/SQFT-YR GROSS-AREA     129.5 KBTU/SQFT-YR NET-AREA
TOTAL SOURCE ENERGY     1329.60 MBTU    250.7 KBTU/SQFT-YR GROSS-AREA     250.7 KBTU/SQFT-YR NET-AREA
PERCENT OF HOURS ANY SYSTEM ZONE OUTSIDE OF THROTTLING RANGE = 12.1
PERCENT OF HOURS ANY PLANT LOAD NOT SATISFIED                =  0.0
NOTE  ELECTRICITY AND/OR FUEL USED TO GENERATE ELECTRICITY IS APPORTIONED BASED
      ON THE YEARLY DEMAND.  ALL OTHER ENERGY TYPES ARE APPORTIONED HOURLY.
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BUILDINGS 402, 410
ANNUAL ENERGY SAVINGS SUMMARY

(PER BUILDING)

Item	Baseline	ECO	Annual Energy Savings	Adj. Annual Energy Savings*
Annual Electric (MBTU)	504.36	320.79	183.57	996.76
Annual Natural Gas (MBTU)	231.80	366.27	-134.47	-730.15
Electric Demand June (KW)	32.11	27.44	4.68	25.39
Electric Demand July (KW)	34.89	30.33	4.56	24.77
Electric Demand August (KW)	33.79	29.31	4.48	24.33

*Energy savings prorated on a square foot basis:

Baseline Model Bldg 409 (sq.ft.)	5304
ECO Model Bldg 402 (sq.ft.)	28800
Square Footage Adjustment Factor	5.430

LIFE CYCLE COST ANALYSIS SUMMARY
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

LOCATION:	Fort Riley	REGION: 2 (Kansas)		PROJECT NO:	1406-005
PROJECT TITLE:	Feasibility Study for HVAC Upgrade			FISCAL YEAR:	1995
ANALYSIS DATE:	05/04/95	ECONOMIC LIFE:	20	PREPARED BY:	C. Wohlert

1. INVESTMENT: **BLDG 402 - Replace 1 SZ & 2 MZ AHUs w/ 3 VAV AHUs**

A.	CONSTRUCTION COST	=	$70,718	
B.	SIOH COST	(5.5% of 1A) =	$3,889	
C.	DESIGN COST	(6.0% of 1A) =	$4,243	
D.	TOTAL COST	(1A +1B +1C) =	$78,851	
E.	SALVAGE VALUE OF EXISTING EQUIPMENT =		$0	
F.	PUBLIC UTILITY COMPANY REBATE =		$0	
G.	TOTAL INVESTMENT	(1D -1E -1F) =	------->	$78,851

2. ENERGY SAVINGS (+) OR COST (-):

DATE OF NISTR 85-3273-9 USED FOR DISCOUNT FACTORS: JAN '95

	ENERGY SOURCE	FUEL COST $/MBTU (1)	SAVINGS MBTU/YR (2)	ANNUAL $ SAVINGS (3)	DISCOUNT FACTOR (4)	DISCOUNTED SAVINGS (5)	
A.	ELECT.	$12.10	997	$12,061	15.88	$191,525	
B.	DIST	$0.00	0	$0	19.16	$0	
C.	NAT GAS	$4.12	(730)	($3,008)	18.30	($55,050)	
D.	COAL	$0.00	0	$0	16.62	$0	
E.	ELEC. DEMAND			$1,309	14.88	$19,478	
F.	TOTAL		267	$10,362		-------->	$155,953

3. NON-ENERGY SAVINGS (+) OR COST (-)

A. ANNUAL RECURRING (+/-)

1 ANNUAL MAINTENANCE	$0	14.88	$0
2	$0	14.88	$0
3	$0	14.88	$0
4 TOTAL ANNUAL DISC. SAVINGS (+) / COST	$0		$0

B. NON-RECURRING (+/-)

ITEM	SAVINGS (+) COST(-) (1)	YEAR OF OCCURRENCE (2)	DISCOUNT FACTOR (3) (TABLE A-2)	DISCOUNTED SAVINGS/COST (4)
a. BASELINE EQUIP. REPLCMNT.	$49,221	5	0.863	$42,478
b.				$0
c.				$0
d.				$0
e.				$0
f. TOTAL	$49,221			$42,478

C. TOTAL NON-ENERGY DISCOUNTED SAVINGS (+) OR COST (-) (3A4 + 3Bf4) = $42,478

4.	FIRST YEAR DOLLAR SAVINGS (+) / COSTS (-)	(2F3+3A4+(3Bf1/Economic Life))	$12,823
5.	SIMPLE PAYBACK (SPB) IN YEARS (MUST BE < 10 YEARS TO QUALIFY)	(1G/4) =	6.15
6.	TOTAL NET DISCOUNTED SAVINGS	(2F5 + 3C) =	$198,431
7.	DISCOUNTED SAVINGS-TO-INVESTMENT RATIO (SIR) (MUST HAVE SIR > 1.25 TO QUALIFY)	(6/1G) =	2.52

ENGINEER'S OPINION OF PROBABLE COST

PROJECT	Fort Riley Feasibility Study for HVAC Upgrade	**SHEET** 1 **OF** 1	
ENGINEER	E M C Engineers, Inc. Denver, CO	**DATE PREPARED**	4-May-95
		ESTIMATOR	C. Wohlert
		CHECKED BY	A. Niemeyer

Line No.	Item Refer Code	Item Description	Unit of Measure	MATERIAL COST Quantity	MATERIAL COST Unit Cost	MATERIAL COST Total	LABOR COST Crew/ Worker	LABOR COST Hours/ Unit	LABOR COST Total	TOTAL
1		**BUILDING 402**								
2		**PROPOSED SYSTEM MODIFICATIONS**								
3										
4		*NEW SYSTEMS INSTALLATION*								
5	AHUH1300	1,300 CFM AHU	EA.	1.0	$2,296.53	$2,297	Q-5	13.9965	$271	$2,568
6	AHU10000	10,000 CFM AHU, COOLING ONLY	EA.	1.0	$4,820.78	$4,821	Q-6	44.444	$894	$5,714
7	AHU12000	12,000 CFM AHU, COOLING ONLY	EA.	1.0	$5,499.08	$5,499	Q-6	52.174	$1,049	$6,548
8	VSD3	VARIABLE SPEED DRIVE W/ CONTRLER,3HP	EA.	1.0	$2,238.39	$2,238	1-ELEC	10.5	$220	$2,458
9	VSD7.5	VARIABLE SPEED DRIVE W/ CONTRLER,7.5HP	EA.	2.0	$2,728.70	$5,457	1-ELEC	12.5	$523	$5,981
10	VAVBX24	VAV BOX, 2400 CFM, ELEC	EA.	11.0	$287.31	$3,160	1-SHEE	1.33	$304	$3,465
11	STLPIP2.5	STEEL PIPE SCH. 40, 2.5" W/HANGERS	L.F.	154.0	$5.28	$813	Q-15	0.34	$1,015	$1,829
12		VALVES AND FITTINGS ADD 15%				$122			$152	$274
13	INSLPIP2.5	2.5" FIBERGLASS PIPE INSULATION, 1.5" THCK	L.F.	154.0	$1.60	$246	Q-14	0.089	$252	$499
14	DUCT5000	GAL. STEEL DUCTWORK, 2000 TO 5000 LB.	LB.	3290.0	$0.45	$1,466	Q-10	0.087	$5,561	$7,027
15	DTINSL2"	DUCT INSLULATION, 2" THICK	S.F.	1566.7	$0.83	$1,306	Q-14	0.053	$1,529	$2,835
16	E-TSTAT1	SINGLE SETPOINT ELEC. TSTAT, 3 WIRE	EA.	11.0	$24.23	$266	1-ELEC	0.8	$184	$451
17	WIRE#12	COPPER WIRING #12	C.L.F.	5.1	$7.41	$38	1-ELEC	0.727	$78	$115
18	REHEAT2	REHEAT COIL, 2ROW, 24"x12"	EA.	8.0	$138.57	$1,109	Q-5	1.32	$205	$1,313
19	REHEAT1.5	REHEAT COIL, 2ROW, 1.5'x1'		2.0	$129.36	$259	Q-5	1.32	$51	$310
20	STLPIP0.75	STEEL PIPE SCH. 40, 0.75" W/HANGERS	L.F.	300.0	$1.51	$453	1-PLUM	0.2	$1,292	$1,746
21		VALVES AND FITTINGS ADD 15%				$68			$194	$262
22	INSLPIP0.75	0.75" FIBERGLASS PIPE INSULATION, 1" THCK	L.F.	300.0	$0.61	$183	Q-14	0.07	$387	$570
23										
24										
25		*EXISTING SYSTEMS DEMOLITION*								
26		AHU DEMOLITION	TON	2.8			Q-5	17.778	$965	$965
27		DUCT DEMOLITION	TON	2.3			Q-5	17.778	$793	$793
28		PIPING DEMOLITION 2-4"	L.F.	128.0			1-PLUM	0.053	$146	$146
29										
30										
31		**SUBTOTAL**				$29,802			$16,066	$45,868
32	OH	OVERHEAD			17%	$5,007			$2,699	$7,706
33	PRO	PROFIT			10%	$3,481			$1,877	$5,357
34	CONT	CONTINGENCY			20%	$7,658			$4,128	$11,786
35	**TOTAL COST**		-	-	-	$45,948	-	-	$24,770	$70,718

ENGINEER'S OPINION OF PROBABLE COST

PROJECT	Fort Riley Feasibility Study for HVAC Upgrade	**SHEET**	1 OF 1
ENGINEER	E M C Engineers, Inc.	**DATE PREPARED**	4-May-95
	Denver, CO	**ESTIMATOR**	C. Wohlert
		CHECKED BY	A. Niemeyer

Line No.	Item Refer Code	Item Description	Unit of Measure	MATERIAL COST Quantity	MATERIAL COST Unit Cost	MATERIAL COST Total	LABOR COST Crew/ Worker	LABOR COST Hours/ Unit	LABOR COST Total	TOTAL
1		**BUILDING 402**								
2		**NON-RECURRING**								
3										
4		*NEW SYSTEMS INSTALLATION*								
5	AHUH1300	1,300 CFM AHU	EA.	1.0	$2,296.53	$2,297	Q-5	13.9965	$271	$2,568
6	AHUH10000	10,000 CFM AHU	EA.	1.0	$5,784.93	$5,785	Q-6	46.6662	$938	$6,723
7	AHUH12000	12,000 CFM AHU	EA.	1.0	$6,598.89	$6,599	Q-6	54.7827	$1,101	$7,700
8	STLPIP2.5	STEEL PIPE SCH. 40, 2.5" W/HANGERS	L.F.	154.0	$5.28	$813	Q-15	0.34	$1,015	$1,829
9		VALVES AND FITTINGS ADD 15%				$122			$152	$274
10	INSLPIP2.5	2.5" FIBERGLASS PIPE INSULATION, 1.5" THCK	L.F.	154.0	$1.60	$246	Q-14	0.089	$252	$499
11	DUCT5000	GAL. STEEL DUCTWORK, 2000 TO 5000 LB.	LB.	3290.0	$0.45	$1,466	Q-10	0.087	$5,561	$7,027
12	DTINSL2"	DUCT INSLULATION, 2" THICK	S.F.	1566.7	$0.83	$1,306	Q-14	0.053	$1,529	$2,835
13	E-TSTAT1	SINGLE SETPOINT ELEC. TSTAT, 3 WIRE	EA.	11.0	$24.23	$266	1-ELEC	0.8	$184	$451
14	WIRE#12	COPPER WIRING #12	C.L.F.	5.1	$7.41	$38	1-ELEC	0.727	$78	$115
15										
16										
17										
18										
19										
20		*EXISTING SYSTEMS DEMOLITION*								
21		AHU DEMOLITION	TON	2.8			Q-5	17.778	$965	$965
22		DUCT DEMOLITION	TON	2.3			Q-5	17.778	$793	$793
23		PIPING DEMOLITION 2-4"	L.F.	128.0			1-PLUM	0.053	$146	$146
24										
25										
26										
27										
28										
29										
30										
31		**SUBTOTAL**				$18,938			$12,987	$31,925
32	OH	OVERHEAD			17%	$3,182			$2,182	$5,363
33	PRO	PROFIT			10%	$2,212			$1,517	$3,729
34	CONT	CONTINGENCY			20%	$4,866			$3,337	$8,204
35	**TOTAL COST**		-	-	-	$29,198	-	-	$20,023	$49,221

ENGINEER'S OPINION OF PROBABLE COST

PROJECT	Fort Riley Feasibility Study for HVAC Upgrade	SHEET 1 OF 1	
ENGINEER	E M C Engineers, Inc. Denver, CO	DATE PREPARED	4-May-95
		ESTIMATOR	C. Wohlert
		CHECKED BY	A. Niemeyer

Line No.	Item Refer Code	Item Description	Unit of Measure	MATERIAL COST Quantity	MATERIAL COST Unit Cost	MATERIAL COST Total	LABOR COST Crew/ Worker	LABOR COST Hours/ Unit	LABOR COST Total	TOTAL
1		**BUILDING 402**								
2		***ANNUAL RECURRING***								
3		***ANNUAL MAINTENANCE COST - BASELINE***								
4										
5										
6										
7										
8										
9										
10										
11										
12										
13										
14										
15	**TOTAL ANNUAL MAINTENANCE COST - BASELINE**		-	-	-	$0	-	-	$0	$0
16										
17		***ANNUAL MAINTENANCE COST - NEW HVAC REPLACEMENT***								
18										
19										
20										
21										
22										
23										
24										
25										
26										
27										
28										
29	**TOTAL ANNUAL MAINTENANCE COST - BASELINE**		-	-	-	$0	-	-	$0	$0
30										
31										
32										
33										
34										
35	**TOTAL ANNUAL MAINTENANCE COST SAVINGS**		-	-	-	$0	-	-	$0	$0

DEMAND LIMITING ANALYSIS BUILDING 402

SUMMER PEAK (KW) = 27812	1993 JUL BILL 7/1-8/2 ACTUAL	1993 AUG BILL 8/2-9/1 ACTUAL	1993 SEP BILL 9/3-10/1 ACTUAL	1993 OCT BILL 10/1-11/1 ACTUAL	1993 NOV BILL 11/1-12/1 ACTUAL	1993 DEC BILL 12/1-1/3 ACTUAL	1993 JAN BILL 1/4-2/1 ACTUAL	1993 FEB BILL 2/1-3/1 ACTUAL	1993 MAR BILL 3/3-4/1 ACTUAL	1993 APR BILL 4/1-5/3 ACTUAL	1993 MAY BILL 5/3-6/1 ACTUAL	1993 JUN BILL 6/1-7/1 ACTUAL
BASE CASE												
CAPACITY (KW)	32472	34452	26136	20754	26400	22752	27108	25812	23310	21834	21996	30096
POWER FACTOR (%)	99.20%	99.10%	99.10%	99.90%	99.80%	99.70%	99.50%	99.60%	99.60%	99.80%	99.60%	98.80%
CAPACITY (KVA)	32734	34765	26373	20775	26453	22820	27244	25916	23404	21878	22084	30462
80% SUMMER PEAK (KVA)	27812	27812	27812	27812	27812	27812	27812	27812	27812	27812	27812	27812
CONTRACT MINIMUM (KVA)	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643
BILLING CAPACITY (KVA)	32734	34765	27812	27812	27812	27812	27812	27812	27812	27812	27812	30462
ACTUAL OR 80% PEAK	ACTUAL	ACTUAL	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	ACTUAL
200 KVA @ $4.45	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00
NEXT 400 @ $4.25	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00
REMAINING @ $4.05	$130,142.18	$138,367.78	$110,208.22	$110,208.22	$110,208.22	$110,208.22	$110,208.22	$110,208.22	$110,208.22	$110,208.22	$110,208.22	$120,939.23
SUB DISCOUNT $.20	($6,546.77)	($6,952.98)	($5,562.38)	($5,562.38)	($5,562.38)	($5,562.38)	($5,562.38)	($5,562.38)	($5,562.38)	($5,562.38)	($5,562.38)	($6,092.31)
CAPACITY CHARGE	$126,185.40	$134,004.80	$107,235.84	$107,235.84	$107,235.84	$107,235.84	$107,235.84	$107,235.84	$107,235.84	$107,235.84	$107,235.84	$117,436.92
TOTAL ENERGY (KWH)	16,920,000	16,200,000	10,980,000	10,140,000	11,160,000	12,930,000	12,600,000	12,270,000	12,480,000	11,070,000	9,720,000	13,170,000
50*KVA @ $.03924	$64,223.85	$68,208.70	$54,566.96	$54,566.96	$54,566.96	$54,566.96	$54,566.96	$54,566.96	$54,566.96	$54,566.96	$54,566.96	$59,765.54
100*KVA @ $.03404	$111,426.10	$118,339.66	$94,671.73	$94,671.73	$94,671.73	$94,671.73	$94,671.73	$94,671.73	$94,671.73	$94,671.73	$94,671.73	$103,691.08
250*KVA @ $.03084	$252,378.15	$268,037.26	$209,965.32	$184,059.72	$214,429.80	$214,429.80	$214,429.80	$214,429.80	$214,429.80	$212,740.92	$171,106.92	$234,858.46
EXCESS @ $.02864	$109,589.57	$65,701.49	$0.00	$0.00	$1,009.19	$51,701.99	$42,250.79	$32,799.59	$38,813.99	$0.00	$0.00	$28,221.42
ENERGY CHARGE	$537,617.67	$520,287.11	$359,204.01	$333,298.41	$364,677.69	$415,370.49	$405,919.29	$396,468.09	$402,482.49	$361,979.61	$320,345.61	$426,536.49
TOTAL CHARGE LESS ECA	$663,803.07	$654,291.92	$466,439.85	$440,534.25	$471,913.53	$522,606.33	$513,155.13	$503,703.93	$509,718.33	$469,215.45	$427,581.45	$543,973.42
DEMAND REDUCTION (KW)	**24.77**	**24.33**	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**25.39**
CAPACITY (KW)	32447	34428	26136	20754	26400	22752	27108	25812	23310	21834	21996	30071
POWER FACTOR (%)	99.20%	99.10%	99.10%	99.90%	99.80%	99.70%	99.50%	99.60%	99.60%	99.80%	99.60%	98.80%
CAPACITY (KVA)	32709	34740	26373	20775	26453	22820	27244	25916	23404	21878	22084	30436
80% SUMMER PEAK (KVA)	27792	27792	27792	27792	27792	27792	27792	27792	27792	27792	27792	27792
CONTRACT MINIMUM (KVA)	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643
BILLING CAPACITY (KVA)	32709	34740	27792	27792	27792	27792	27792	27792	27792	27792	27792	30436
ACTUAL OR 80% PEAK	ACTUAL	ACTUAL	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	ACTUAL
200 KVA @ $4.45	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00
NEXT 400 @ $4.25	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00
REMAINING @ $4.05	$130,041.07	$138,268.37	$110,128.69	$110,128.69	$110,128.69	$110,128.69	$110,128.69	$110,128.69	$110,128.69	$110,128.69	$110,128.69	$120,835.15
SUB DISCOUNT $.20	($6,541.78)	($6,948.07)	($5,558.45)	($5,558.45)	($5,558.45)	($5,558.45)	($5,558.45)	($5,558.45)	($5,558.45)	($5,558.45)	($5,558.45)	($6,087.17)
CAPACITY CHARGE	$126,089.28	$133,910.30	$107,160.24	$107,160.24	$107,160.24	$107,160.24	$107,160.24	$107,160.24	$107,160.24	$107,160.24	$107,160.24	$117,337.98
TOTAL ENERGY (KWH)	16,920,000	16,200,000	10,980,000	10,140,000	11,160,000	12,930,000	12,600,000	12,270,000	12,480,000	11,070,000	9,720,000	13,170,000
50*KVA @ $.03924	$64,174.87	$68,160.54	$54,528.43	$54,528.43	$54,528.43	$54,528.43	$54,528.43	$54,528.43	$54,528.43	$54,528.43	$54,528.43	$59,715.12
100*KVA @ $.03404	$111,341.11	$118,256.11	$94,604.89	$94,604.89	$94,604.89	$94,604.89	$94,604.89	$94,604.89	$94,604.89	$94,604.89	$94,604.89	$103,603.60
250*KVA @ $.03084	$252,185.66	$267,848.00	$210,056.16	$184,150.56	$214,278.40	$214,278.40	$214,278.40	$214,278.40	$214,278.40	$212,831.76	$171,197.76	$234,660.32
EXCESS @ $.02864	$109,875.58	$65,982.69	$0.00	$0.00	$1,234.15	$51,926.95	$42,475.75	$33,024.55	$39,038.95	$0.00	$0.00	$28,515.83
ENERGY CHARGE	$537,577.23	$520,247.35	$359,189.48	$333,283.88	$364,645.88	$415,338.68	$405,887.48	$396,436.28	$402,450.68	$361,965.08	$320,331.08	$426,494.86
TOTAL CHARGE LESS ECA	$663,666.51	$654,157.65	$466,349.72	$440,444.12	$471,806.12	$522,498.92	$513,047.72	$503,596.52	$509,610.92	$469,125.32	$427,491.32	$543,832.84
SUMMARY												
MONTHLY DIFFERENCE	$136.56	$134.27	$90.13	$90.13	$107.41	$107.41	$107.41	$107.41	$107.41	$90.13	$90.13	$140.58
ANNUAL DIFFERENCE.............		**$1,309.02**										

BUILDINGS 402, 410
ANNUAL ENERGY SAVINGS SUMMARY

(PER BUILDING)

Item	Baseline	ECO	Annual Energy Savings	Adj. Annual Energy Savings*
Annual Electric (MBTU)	504.36	320.79	183.57	996.76
Annual Natural Gas (MBTU)	231.80	366.27	-134.47	-730.15
Electric Demand June (KW)	32.11	27.44	4.68	25.39
Electric Demand July (KW)	34.89	30.33	4.56	24.77
Electric Demand August (KW)	33.79	29.31	4.48	24.33

*Energy savings prorated on a square foot basis:

Baseline Model Bldg 409 (sq.ft.)	5304
ECO Model Bldg 402 (sq.ft.)	28800
Square Footage Adjustment Factor	5.430

LIFE CYCLE COST ANALYSIS SUMMARY
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

LOCATION:	Fort Riley	REGION: 2 (Kansas)		PROJECT NO:	1406-005
PROJECT TITLE:	Feasibility Study for HVAC Upgrade			FISCAL YEAR:	1995
ANALYSIS DATE:	05/04/95	ECONOMIC LIFE:	20	PREPARED BY:	C. Wohlert

1. INVESTMENT: **BLDG 410 - Replace 3 MZ AHUs w/ 3 VAV AHUs**

A.	CONSTRUCTION COST	=	$69,518	
B.	SIOH COST	(5.5% of 1A) =	$3,823	
C.	DESIGN COST	(6.0% of 1A) =	$4,171	
D.	TOTAL COST	(1A +1B +1C) =	$77,512	
E.	SALVAGE VALUE OF EXISTING EQUIPMENT	=	$0	
F.	PUBLIC UTILITY COMPANY REBATE	=	$0	
G.	TOTAL INVESTMENT	(1D -1E -1F) =	------->	$77,512

2. ENERGY SAVINGS (+) OR COST (-):

DATE OF NISTR 85-3273-9 USED FOR DISCOUNT FACTORS: JAN '95

	ENERGY SOURCE	FUEL COST $/MBTU (1)	SAVINGS MBTU/YR (2)	ANNUAL $ SAVINGS (3)	DISCOUNT FACTOR (4)	DISCOUNTED SAVINGS (5)	
A.	ELECT.	$12.10	997	$12,061	15.88	$191,525	
B.	DIST	$0.00	0	$0	19.16	$0	
C.	NAT GAS	$4.12	(730)	($3,008)	18.30	($55,050)	
D.	COAL	$0.00	0	$0	16.62	$0	
E.	ELEC. DEMAND			$1,309	14.88	$19,478	
F.	TOTAL		267	$10,362		-------->	$155,953

3. NON-ENERGY SAVINGS (+) OR COST (-)

A. ANNUAL RECURRING (+/-)

1 ANNUAL MAINTENANCE	$0	14.88	$0
2	$0	14.88	$0
3	$0	14.88	$0
4 TOTAL ANNUAL DISC. SAVINGS (+) / COST	$0		$0

B. NON-RECURRING (+/-)

ITEM	SAVINGS (+) COST(-) (1)	YEAR OF OCCURRENCE (2)	DISCOUNT FACTOR (3) (TABLE A-2)	DISCOUNTED SAVINGS/COST (4)
a. BASELINE EQUIP. REPLCMNT.	$51,813	5	0.863	$44,714
b.				$0
c.				$0
d.				$0
e.				$0
f. TOTAL	$51,813			$44,714

C. TOTAL NON-ENERGY DISCOUNTED SAVINGS (+) OR COST (-) (3A4 + 3Bf4) = $44,714

4.	FIRST YEAR DOLLAR SAVINGS (+) / COSTS (-)	(2F3+3A4+(3Bf1/Economic Life))	$12,952
5.	SIMPLE PAYBACK (SPB) IN YEARS (MUST BE < 10 YEARS TO QUALIFY)	(1G/4) =	5.98
6.	TOTAL NET DISCOUNTED SAVINGS	(2F5 + 3C) =	$200,668
7.	DISCOUNTED SAVINGS-TO-INVESTMENT RATIO (SIR) (MUST HAVE SIR > 1.25 TO QUALIFY)	(6/1G) =	2.59

ENGINEER'S OPINION OF PROBABLE COST

PROJECT	Fort Riley Feasibility Study for HVAC Upgrade	**SHEET**	1 OF 1
ENGINEER	E M C Engineers, Inc.	**DATE PREPARED**	4-May-95
		ESTIMATOR	C. Wohlert
	Denver, CO	**CHECKED BY**	A. Niemeyer

Line No.	Item Refer Code	Item Description	Unit of Measure	MATERIAL COST Quantity	MATERIAL COST Unit Cost	MATERIAL COST Total	LABOR COST Crew/ Worker	LABOR COST Hours/ Unit	LABOR COST Total	TOTAL
1		**BUILDING 410**								
2		**PROPOSED SYSTEM MODIFICATIONS**								
3										
4		*NEW SYSTEMS INSTALLATION*								
5	AHU3200	3,200 CFM AHU, COOLING ONLY	EA.	1.0	$2,519.40	$2,519	Q-5	20	$388	$2,907
6	AHU12000	12,000 CFM AHU, COOLING ONLY	EA.	2.0	$5,499.08	$10,998	Q-6	52.174	$2,098	$13,096
7	VSD3	VARIABLE SPEED DRIVE W/ CONTRLER,3HP	EA.	1.0	$2,238.39	$2,238	1-ELEC	10.5	$220	$2,458
8	VSD7.5	VARIABLE SPEED DRIVE W/ CONTRLER,7.5HP	EA.	2.0	$2,728.70	$5,457	1-ELEC	12.5	$523	$5,981
9	VAVBX12	VAV BOX, 1200 CFM, ELEC	EA.	2.0	$271.32	$543	1-SHEE	1.13	$47	$590
10	VAVBX24	VAV BOX, 2400 CFM, ELEC	EA.	5.0	$287.31	$1,437	1-SHEE	1.33	$138	$1,575
11	STLPIP2.5	STEEL PIPE SCH. 40, 2.5" W/HANGERS	L.F.	170.0	$5.28	$898	Q-15	0.34	$1,121	$2,019
12		VALVES AND FITTINGS ADD 15%				$135			$168	$303
13	INSLPIP2.5	2.5" FIBERGLASS PIPE INSULATION, 1.5" THCK	L.F.	170.0	$1.60	$272	Q-14	0.089	$279	$550
14	DUCT5000	GAL. STEEL DUCTWORK, 2000 TO 5000 LB.	LB.	3500.0	$0.45	$1,560	Q-10	0.087	$5,916	$7,476
15	DTINSL2"	DUCT INSLULATION, 2" THICK	S.F.	1167.0	$0.83	$973	Q-14	0.053	$1,139	$2,112
16	E-TSTAT1	SINGLE SETPOINT ELEC. TSTAT, 3 WIRE	EA.	8.0	$24.23	$194	1-ELEC	0.8	$134	$328
17	WIRE#12	COPPER WIRING #12	C.L.F.	3.7	$7.41	$27	1-ELEC	0.727	$56	$84
18	REHEAT2	REHEAT COIL, 2ROW, 24"x12"	EA.	5.0	$138.57	$693	Q-5	1.32	$128	$821
19	REHEAT1.5	REHEAT COIL, 2ROW, 1.5'x1'	EA.	2.0	$129.36	$259	Q-5	1.32	$51	$310
20	STLPIP0.75	STEEL PIPE SCH. 40, 0.75" W/HANGERS	L.F.	300.0	$1.51	$453	1-PLUM	0.2	$1,292	$1,746
21		VALVES AND FITTINGS ADD 15%				$68			$194	$262
22	INSLPIP0.75	0.75" FIBERGLASS PIPE INSULATION, 1" THCK	L.F.	300.0	$0.61	$183	Q-14	0.07	$387	$570
23										
24										
25		*EXISTING SYSTEMS DEMOLITION*								
26		AHU DEMOLITION	TON	2.8			Q-5	17.778	$965	$965
27		DUCT DEMOLITION	TON	2.3			Q-5	17.778	$793	$793
28		PIPING DEMOLITION 2-4"	L.F.	128.0			1-PLUM	0.053	$146	$146
29										
30										
31		**SUBTOTAL**				$28,907			$16,183	$45,090
32	OH	OVERHEAD			17%	$4,856			$2,719	$7,575
33	PRO	PROFIT			10%	$3,376			$1,890	$5,266
34	CONT	CONTINGENCY			20%	$7,428			$4,158	$11,586
35	**TOTAL COST**		-	-	-	$44,567	-	-	$24,950	$69,518

ENGINEER'S OPINION OF PROBABLE COST

PROJECT	Fort Riley Feasibility Study for HVAC Upgrade	**SHEET** 1 **OF** 1	
		DATE PREPARED	4-May-95
ENGINEER	E M C Engineers, Inc.	**ESTIMATOR**	C. Wohlert
	Denver, CO	**CHECKED BY**	A. Niemeyer

Line No.	Item Refer Code	Item Description	Unit of Measure	MATERIAL COST Quantity	MATERIAL COST Unit Cost	MATERIAL COST Total	LABOR COST Crew/ Worker	LABOR COST Hours/ Unit	LABOR COST Total	TOTAL
1		**BUILDING 410**								
2		**NON-RECURRING**								
3										
4		*NEW SYSTEMS INSTALLATION*								
5	AHUH3200	3,200 CFM AHU	EA.	1.0	$3,023.28	$3,023	Q-5	21	$407	$3,430
6	AHUH12000	12,000 CFM AHU	EA.	2.0	$6,598.89	$13,198	Q-6	54.7827	$2,203	$15,401
7	STLPIP2.5	STEEL PIPE SCH. 40, 2.5" W/HANGERS	L.F.	170.0	$5.28	$898	Q-15	0.34	$1,121	$2,019
8		VALVES AND FITTINGS ADD 15%				$135			$168	$303
9	INSLPIP2.5	2.5" FIBERGLASS PIPE INSULATION, 1.5" THCK	L.F.	170.0	$1.60	$272	Q-14	0.089	$279	$550
10	DUCT5000	GAL. STEEL DUCTWORK, 2000 TO 5000 LB.	LB.	3500.0	$0.45	$1,560	Q-10	0.087	$5,916	$7,476
11	DTINSL2"	DUCT INSLULATION, 2" THICK	S.F.	1167.0	$0.83	$973	Q-14	0.053	$1,139	$2,112
12	E-TSTAT1	SINGLE SETPOINT ELEC. TSTAT, 3 WIRE	EA.	8.0	$24.23	$194	1-ELEC	0.8	$134	$328
13	WIRE#12	COPPER WIRING #12	C.L.F.	3.7	$7.41	$27	1-ELEC	0.727	$56	$84
14										
15										
16										
17										
18										
19										
20										
21										
22										
23										
24										
25		*EXISTING SYSTEMS DEMOLITION*								
26		AHU DEMOLITION	TON	2.8			Q-5	17.778	$965	$965
27		DUCT DEMOLITION	TON	2.3			Q-5	17.778	$793	$793
28		PIPING DEMOLITION 2-4"	L.F.	128.0			1-PLUM	0.053	$146	$146
29										
30										
31		**SUBTOTAL**				$20,279			$13,327	$33,606
32	OH	OVERHEAD			17%	$3,407			$2,239	$5,646
33	PRO	PROFIT			10%	$2,369			$1,557	$3,925
34	CONT	CONTINGENCY			20%	$5,211			$3,425	$8,635
35	**TOTAL COST**		-	-	-	$31,266	-	-	$20,547	$51,813

ENGINEER'S OPINION OF PROBABLE COST		SHEET 1	OF 1
PROJECT	Fort Riley Feasibility Study for HVAC Upgrade	DATE PREPARED	4-May-95
ENGINEER	E M C Engineers, Inc. Denver, CO	ESTIMATOR	C. Wohlert
		CHECKED BY	A. Niemeyer

Line No.	Item Refer Code	Item Description	Unit of Measure	MATERIAL COST			LABOR COST			TOTAL
				Quantity	Unit Cost	Total	Crew/ Worker	Hours/ Unit	Total	
1		**BUILDING 410**								
2		***ANNUAL RECURRING***								
3		***ANNUAL MAINTENANCE COST - BASELINE***								
4										
5										
6										
7										
8										
9										
10										
11										
12										
13										
14										
15	**TOTAL ANNUAL MAINTENANCE COST - BASELINE**		-	-	-	$0	-	-	$0	$0
16										
17		***ANNUAL MAINTENANCE COST - NEW HVAC REPLACEMENT***								
18										
19										
20										
21										
22										
23										
24										
25										
26										
27										
28										
29	**TOTAL ANNUAL MAINTENANCE COST - BASELINE**		-	-	-	$0	-	-	$0	$0
30										
31										
32										
33										
34										
35	**TOTAL ANNUAL MAINTENANCE COST SAVINGS**		-	-	-	$0	-	-	$0	$0

BUILDING 7404
ANNUAL ENERGY SAVINGS SUMMARY

Item	Baseline	ECO	Annual Energy Savings	Adj. Annual Energy Savings*
Annual Electric (MBTU)	1362.38	998.60	363.78	363.78
Annual Natural Gas (MBTU)			0.00	0.00
Electric Demand June (KW)	192.01	182.14	9.87	9.87
Electric Demand July (KW)	198.34	191.68	6.66	6.66
Electric Demand August (KW)	201.02	194.26	6.76	6.76

*Energy savings prorated on a square foot basis:

Baseline Model Bldg 7810 (sq.ft.)	41892
ECO Model Bldg 7404 (sq.ft.)	41892
Square Footage Adjustment Factor	1.000

LIFE CYCLE COST ANALYSIS SUMMARY
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

LOCATION:	Fort Riley	REGION: 2 (Kansas)		PROJECT NO:	1406-005
PROJECT TITLE:	Feasibility Study for HVAC Upgrade			FISCAL YEAR:	1995
ANALYSIS DATE:	05/04/95	ECONOMIC LIFE:	20	PREPARED BY:	C. Wohlert

1. INVESTMENT: **BLDG 7404 - Convert Existing (2) Cooling only MZs to VAV Cooling AHUs**

A.	CONSTRUCTION COST	=	$23,368	
B.	SIOH COST	(5.5% of 1A) =	$1,285	
C.	DESIGN COST	(6.0% of 1A) =	$1,402	
D.	TOTAL COST	(1A +1B +1C) =	$26,055	
E.	SALVAGE VALUE OF EXISTING EQUIPMENT	=	$0	
F.	PUBLIC UTILITY COMPANY REBATE	=	$0	
G.	TOTAL INVESTMENT	(1D -1E -1F) =	------->	$26,055

2. ENERGY SAVINGS (+) OR COST (-):
DATE OF NISTR 85-3273-9 USED FOR DISCOUNT FACTORS: JAN '95

	ENERGY SOURCE	FUEL COST $/MBTU (1)	SAVINGS MBTU/YR (2)	ANNUAL $ SAVINGS (3)	DISCOUNT FACTOR (4)	DISCOUNTED SAVINGS (5)	
A.	ELECT.	$12.10	364	$4,402	15.88	$69,900	
B.	DIST	$0.00	0	$0	19.16	$0	
C.	NAT GAS	$4.12	0	$0	18.30	$0	
D.	COAL	$0.00	0	$0	16.62	$0	
E.	ELEC. DEMAND			$378	14.88	$5,629	
F.	TOTAL		364	$4,780		-------->	$75,529

3. NON-ENERGY SAVINGS (+) OR COST (-)
A. ANNUAL RECURRING (+/-)

1 ANNUAL MAINTENANCE	$0	14.88	$0
2	$0	14.88	$0
3	$0	14.88	$0
4 TOTAL ANNUAL DISC. SAVINGS (+) / COST	$0		$0

B. NON-RECURRING (+/-)

ITEM	SAVINGS (+) COST(-) (1)	YEAR OF OCCURRENCE (2)	DISCOUNT FACTOR (3) (TABLE A-2)	DISCOUNTED SAVINGS/COST (4)
a. BASELINE EQUIP. REPLCMNT.	$0	5	0.863	$0
b.				$0
c.				$0
d.				$0
e.				$0
f. TOTAL	$0			$0

C. TOTAL NON-ENERGY DISCOUNTED SAVINGS (+) OR COST (-) (3A4 + 3Bf4) = $0

4.	FIRST YEAR DOLLAR SAVINGS (+) / COSTS (-)	(2F3+3A4+(3Bf1/Economic Life))	$4,780
5.	SIMPLE PAYBACK (SPB) IN YEARS (MUST BE < 10 YEARS TO QUALIFY)	(1G/4) =	5.45
6.	TOTAL NET DISCOUNTED SAVINGS	(2F5 + 3C) =	$75,529
7.	DISCOUNTED SAVINGS-TO-INVESTMENT RATIO (SIR) (MUST HAVE SIR > 1.25 TO QUALIFY)	(6/1G) =	2.90

ENGINEER'S OPINION OF PROBABLE COST

PROJECT	Fort Riley Feasibility Study for HVAC Upgrade	**SHEET** 1 **OF** 1	
		DATE PREPARED	4-May-95
ENGINEER	E M C Engineers, Inc.	**ESTIMATOR**	C. Wohlert
	Denver, CO	**CHECKED BY**	A. Niemeyer

Line No.	Item Refer Code	Item Description	Unit of Measure	MATERIAL COST			LABOR COST			TOTAL
				Quantity	Unit Cost	Total	Crew/ Worker	Hours/ Unit	Total	
1		**BUILDING 7404**								
2		**PROPOSED SYSTEM MODIFICATIONS**								
3										
4		BLANK OFF HOT DECK	EA.	1.0	$50.00	$50	1-CLAB	3	$43	$93.4
5	VSD20	VARIABLE SPEED DRIVE W/ CONTRLER,20HP	EA.	2.0	$4,844.03	$9,688	1-ELEC	19	$795	$10,483
6	E-TSTAT1	SINGLE SETPOINT ELEC. TSTAT, 3 WIRE	EA.	12.0	$24.23	$291	1-ELEC	0.8	$201	$492
7	WIRE#12	COPPER WIRING #12	C.L.F.	9.5	$7.41	$70	1-ELEC	0.727	$145	$215
8	VAVCNTL2	VAV BOX CONTROLLER & ACTUATOR, ELEC	EA.	12.0	$155.04	$1,860	1-ELEC	0.33	$83	$1,943
9	CNTV2.5	CONTROL VALVE 2-1/2"	EA.	2.0	$935.09	$1,870	1-PLUM	3.556	$153	$2,023
10										
11										
12										
13										
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27										
28										
29										
30										
31		**SUBTOTAL**				$13,780			$1,377	$15,157
32	OH	OVERHEAD			17%	$2,315			$231	$2,546
33	PRO	PROFIT			10%	$1,609			$161	$1,770
34	CONT	CONTINGENCY			20%	$3,541			$354	$3,895
35	**TOTAL COST**		-	-	-	$21,245	-	-	$2,123	$23,368

ENGINEER'S OPINION OF PROBABLE COST

PROJECT	Fort Riley Feasibility Study for HVAC Upgrade	**SHEET** 1 **OF** 1	
ENGINEER	E M C Engineers, Inc. Denver, CO	**DATE PREPARED**	4-May-95
		ESTIMATOR	C. Wohlert
		CHECKED BY	A. Niemeyer

Line No.	Item Refer Code	Item Description	Unit of Measure	MATERIAL COST Quantity	MATERIAL COST Unit Cost	MATERIAL COST Total	LABOR COST Crew/ Worker	LABOR COST Hours/ Unit	LABOR COST Total	TOTAL
1		**BUILDING 7404**								
2		**NON-RECURRING**								
3										
4										
5										
6										
7										
8										
9										
10										
11										
12										
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24										
25										
26										
27										
28										
29										
30										
31		**SUBTOTAL**				$0			$0	$0
32	OH	OVERHEAD			17%	$0			$0	$0
33	PRO	PROFIT			10%	$0			$0	$0
34	CONT	CONTINGENCY			20%	$0			$0	$0
35	**TOTAL COST**		-	-	-	$0	-	-	$0	$0

ENGINEER'S OPINION OF PROBABLE COST

PROJECT	Fort Riley Feasibility Study for HVAC Upgrade	SHEET 1 OF 1	
ENGINEER	E M C Engineers, Inc.	DATE PREPARED	4-May-95
	Denver, CO	ESTIMATOR	C. Wohlert
		CHECKED BY	A. Niemeyer

Line No.	Item Refer Code	Item Description	Unit of Measure	MATERIAL COST Quantity	MATERIAL COST Unit Cost	MATERIAL COST Total	LABOR COST Crew/ Worker	LABOR COST Hours/ Unit	LABOR COST Total	TOTAL
1		BUILDING 7404								
2		*ANNUAL RECURRING*								
3		***ANNUAL MAINTENANCE COST - BASELINE***								
4										
5										
6										
7										
8										
9										
10										
11										
12										
13										
14										
15	TOTAL ANNUAL MAINTENANCE COST - BASELINE		-	-	-	$0	-	-	$0	$0
16										
17		***ANNUAL MAINTENANCE COST - NEW HVAC REPLACEMENT***								
18										
19										
20										
21										
22										
23										
24										
25										
26										
27										
28										
29	TOTAL ANNUAL MAINTENANCE COST - BASELINE		-	-	-	$0	-	-	$0	$0
30										
31										
32										
33										
34										
35	TOTAL ANNUAL MAINTENANCE COST SAVINGS		-	-	-	$0	-	-	$0	$0

DEMAND LIMITING ANALYSIS BUILDING 7404

SUMMER PEAK (KW) = 27812	1993 JUL BILL 7/1-8/2 ACTUAL	1993 AUG BILL 8/2-9/1 ACTUAL	1993 SEP BILL 9/3-10/1 ACTUAL	1993 OCT BILL 10/1-11/1 ACTUAL	1993 NOV BILL 11/1-12/1 ACTUAL	1993 DEC BILL 12/1-1/3 ACTUAL	1993 JAN BILL 1/4-2/1 ACTUAL	1993 FEB BILL 2/1-3/1 ACTUAL	1993 MAR BILL 3/3-4/1 ACTUAL	1993 APR BILL 4/1-5/3 ACTUAL	1993 MAY BILL 5/3-6/1 ACTUAL	1993 JUN BILL 6/1-7/1 ACTUAL
BASE CASE												
CAPACITY (KW)	32472	34452	26136	20754	26400	22752	27108	25812	23310	21834	21996	30096
POWER FACTOR (%)	99.20%	99.10%	99.10%	99.90%	99.80%	99.70%	99.50%	99.60%	99.60%	99.80%	99.60%	98.80%
CAPACITY (KVA)	32734	34765	26373	20775	26453	22820	27244	25916	23404	21878	22084	30462
80% SUMMER PEAK (KVA)	27812	27812	27812	27812	27812	27812	27812	27812	27812	27812	27812	27812
CONTRACT MINIMUM (KVA)	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643
BILLING CAPACITY (KVA)	32734	34765	27812	27812	27812	27812	27812	27812	27812	27812	27812	30462
ACTUAL OR 80% PEAK	ACTUAL	ACTUAL	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	ACTUAL
200 KVA @ $4.45	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00
NEXT 400 @ $4.25	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00
REMAINING @ $4.05	$130,142.18	$138,367.78	$110,208.22	$110,208.22	$110,208.22	$110,208.22	$110,208.22	$110,208.22	$110,208.22	$110,208.22	$110,208.22	$120,939.23
SUB DISCOUNT $.20	($6,546.77)	($6,952.98)	($5,562.38)	($5,562.38)	($5,562.38)	($5,562.38)	($5,562.38)	($5,562.38)	($5,562.38)	($5,562.38)	($5,562.38)	($6,092.31)
CAPACITY CHARGE	$126,185.40	$134,004.80	$107,235.84	$107,235.84	$107,235.84	$107,235.84	$107,235.84	$107,235.84	$107,235.84	$107,235.84	$107,235.84	$117,436.92
TOTAL ENERGY (KWH)	16,920,000	16,200,000	10,980,000	10,140,000	11,160,000	12,930,000	12,600,000	12,270,000	12,480,000	11,070,000	9,720,000	13,170,000
50*KVA @ $.03924	$64,223.85	$68,208.70	$54,566.96	$54,566.96	$54,566.96	$54,566.96	$54,566.96	$54,566.96	$54,566.96	$54,566.96	$54,566.96	$59,765.54
100*KVA @ $.03404	$111,426.10	$118,339.66	$94,671.73	$94,671.73	$94,671.73	$94,671.73	$94,671.73	$94,671.73	$94,671.73	$94,671.73	$94,671.73	$103,691.08
250*KVA @ $.03084	$252,378.15	$268,037.26	$209,965.32	$184,059.72	$214,429.80	$214,429.80	$214,429.80	$214,429.80	$214,429.80	$212,740.92	$171,106.92	$234,858.46
EXCESS @ $.02864	$109,589.57	$65,701.49	$0.00	$0.00	$1,009.19	$51,701.99	$42,250.79	$32,799.59	$38,813.99	$0.00	$0.00	$28,221.42
ENERGY CHARGE	$537,617.67	$520,287.11	$359,204.01	$333,298.41	$364,677.69	$415,370.49	$405,919.29	$396,468.09	$402,482.49	$361,979.61	$320,345.61	$426,536.49
TOTAL CHARGE LESS ECA	$663,803.07	$654,291.92	$466,439.85	$440,534.25	$471,913.53	$522,606.33	$513,155.13	$503,703.93	$509,718.33	$469,215.45	$427,581.45	$543,973.42
DEMAND REDUCTION (KW)	**6.66**	**6.76**	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**9.87**
CAPACITY (KW)	32465	34445	26136	20754	26400	22752	27108	25812	23310	21834	21996	30086
POWER FACTOR (%)	99.20%	99.10%	99.10%	99.90%	99.80%	99.70%	99.50%	99.60%	99.60%	99.80%	99.60%	98.80%
CAPACITY (KVA)	32727	34758	26373	20775	26453	22820	27244	25916	23404	21878	22084	30452
80% SUMMER PEAK (KVA)	27806	27806	27806	27806	27806	27806	27806	27806	27806	27806	27806	27806
CONTRACT MINIMUM (KVA)	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643
BILLING CAPACITY (KVA)	32727	34758	27806	27806	27806	27806	27806	27806	27806	27806	27806	30452
ACTUAL OR 80% PEAK	ACTUAL	ACTUAL	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	ACTUAL
200 KVA @ $4.45	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00
NEXT 400 @ $4.25	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00
REMAINING @ $4.05	$130,114.98	$138,340.13	$110,186.11	$110,186.11	$110,186.11	$110,186.11	$110,186.11	$110,186.11	$110,186.11	$110,186.11	$110,186.11	$120,898.78
SUB DISCOUNT $.20	($6,545.43)	($6,951.61)	($5,561.29)	($5,561.29)	($5,561.29)	($5,561.29)	($5,561.29)	($5,561.29)	($5,561.29)	($5,561.29)	($5,561.29)	($6,090.31)
CAPACITY CHARGE	$126,159.55	$133,978.52	$107,214.82	$107,214.82	$107,214.82	$107,214.82	$107,214.82	$107,214.82	$107,214.82	$107,214.82	$107,214.82	$117,398.47
TOTAL ENERGY (KWH)	16,920,000	16,200,000	10,980,000	10,140,000	11,160,000	12,930,000	12,600,000	12,270,000	12,480,000	11,070,000	9,720,000	13,170,000
50*KVA @ $.03924	$64,210.68	$68,195.31	$54,556.25	$54,556.25	$54,556.25	$54,556.25	$54,556.25	$54,556.25	$54,556.25	$54,556.25	$54,556.25	$59,745.94
100*KVA @ $.03404	$111,403.24	$118,316.43	$94,653.14	$94,653.14	$94,653.14	$94,653.14	$94,653.14	$94,653.14	$94,653.14	$94,653.14	$94,653.14	$103,657.08
250*KVA @ $.03084	$252,326.37	$267,984.63	$209,990.58	$184,084.98	$214,387.70	$214,387.70	$214,387.70	$214,387.70	$214,387.70	$212,766.18	$171,132.18	$234,781.46
EXCESS @ $.02864	$109,666.51	$65,779.69	$0.00	$0.00	$1,071.75	$51,764.55	$42,313.35	$32,862.15	$38,876.55	$0.00	$0.00	$28,335.83
ENERGY CHARGE	$537,606.79	$520,276.05	$359,199.97	$333,294.37	$364,668.84	$415,361.64	$405,910.44	$396,459.24	$402,473.64	$361,975.57	$320,341.57	$426,520.31
TOTAL CHARGE LESS ECA	$663,766.34	$654,254.58	$466,414.79	$440,509.19	$471,883.66	$522,576.46	$513,125.26	$503,674.06	$509,688.46	$469,190.39	$427,556.39	$543,918.79
SUMMARY												
MONTHLY DIFFERENCE	$36.74	$37.34	$25.07	$25.07	$29.87	$29.87	$29.87	$29.87	$29.87	$25.07	$25.07	$54.63
ANNUAL DIFFERENCE.............		**$378.32**										

EMC ENGINEERS INC. EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/27/1995 16:50:36 LDL RUN 1
DENVER, CO 80227 EXISTING SIMULATION FOR BLDG. 7404 ENL MEN BARRACKS W/O DIN
REPORT- LV-D DETAILS OF EXTERIOR SURFACES IN THE PROJECT TOPEKA, KS

NUMBER OF EXTERIOR SURFACES 9 RECTANGULAR 9 OTHER 0
(U-VALUE INCLUDES INSIDE AIR FILM PLUS OUTSIDE AIR FILM AT 7.5 MPH WINDSPEED)

SURFACE	SPACE	- - - - G L A S S - - - - U-VALUE (BTU/HR-SQFT-F)	AREA (SQFT)	- - - - W A L L - - - - U-VALUE (BTU/HR-SQFT-F)	AREA (SQFT)	- W A L L + G L A S S - U-VALUE (BTU/HR-SQFT-F)	AREA (SQFT)	AZIMUTH
	EXTER-N	0.487	2205.00	0.258	6315.00	0.317	8520.00	NORTH
	EXTER-E	0.487	35.10	0.258	1665.90	0.263	1701.00	EAST
	EXTER-S	0.487	2205.00	0.258	6315.00	0.317	8520.00	SOUTH
	EXTER-W	0.487	35.10	0.258	1665.90	0.263	1701.00	WEST
	EXTER-S	0.000	0.00	0.064	4985.00	0.064	4985.00	ROOF
	EXTER-N	0.000	0.00	0.064	4560.00	0.064	4560.00	ROOF
	EXTER-E	0.000	0.00	0.064	805.00	0.064	805.00	ROOF
	inter-zone	0.000	0.00	0.064	2803.00	0.064	2803.00	ROOF
	EXTER-W	0.000	0.00	0.064	805.00	0.064	805.00	ROOF
	inter-zone	0.000	0.00	0.020	2803.00	0.020	2803.00	UNDERGRND
	EXTER-N	0.000	0.00	0.020	4560.00	0.020	4560.00	UNDERGRND
	EXTER-S	0.000	0.00	0.020	4985.00	0.020	4985.00	UNDERGRND
	EXTER-E	0.000	0.00	0.020	805.00	0.020	805.00	UNDERGRND
	EXTER-W	0.000	0.00	0.020	805.00	0.020	805.00	UNDERGRND

EMC ENGINEERS INC. EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/27/1995 16:50:36 LDL RUN 1
DENVER, CO 80227 EXISTING SIMULATION FOR BLDG. 7404 ENL MEN BARRACKS W/O DIN
REPORT- LV-D DETAILS OF EXTERIOR SURFACES IN THE PROJECT TOPEKA, KS

	AVERAGE U-VALUE/GLASS (BTU/HR-SQFT-F)	AVERAGE U-VALUE/WALLS (BTU/HR-SQFT-F)	AVERAGE U-VALUE WALLS+GLASS (BTU/HR-SQFT-F)	GLASS AREA (SQFT)	OPAQUE AREA (SQFT)	GLASS+OPAQUE AREA (SQFT)
NORTH	0.487	0.258	0.317	2205.00	6315.00	8520.00
EAST	0.487	0.258	0.263	35.10	1665.90	1701.00
SOUTH	0.487	0.258	0.317	2205.00	6315.00	8520.00
WEST	0.487	0.258	0.263	35.10	1665.90	1701.00
ROOF	0.000	0.064	0.064	0.00	13958.00	13958.00
ALL WALLS	0.487	0.258	0.308	4480.20	15961.80	20442.00
WALLS+ROOFS	0.487	0.167	0.209	4480.20	29919.80	34400.00
UNDERGRND	0.000	0.020	0.020	0.00	13958.00	13958.00
BUILDING	0.487	0.120	0.154	4480.20	43877.80	48358.00

*** BUILDING ***

FLOOR AREA	13958	SQFT	1297	SQMT
VOLUME	418734	CUFT	11859	CUMT

	COOLING LOAD				HEATING LOAD	
TIME	AUG 24	7PM			SEP 18	2AM
DRY-BULB TEMP	92F	33C			50F	10C
WET-BULB TEMP	76F	24C			48F	9C

	SENSIBLE (KBTU/H)	SENSIBLE (KW)	LATENT (KBTU/H)	LATENT (KW)	HEATING SENSIBLE (KBTU/H)	HEATING SENSIBLE (KW)
WALLS	69.083	20.233	0.000	0.000	-79.915	-23.405
ROOFS	19.337	5.663	0.000	0.000	-13.227	-3.874
GLASS CONDUCTION	40.916	11.983	0.000	0.000	-56.113	-16.434
GLASS SOLAR	99.635	29.181	0.000	0.000	17.386	5.092
DOOR	0.000	0.000	0.000	0.000	0.000	0.000
INTERNAL SURFACES	0.000	0.000	0.000	0.000	0.000	0.000
UNDERGROUND SURFACES	-1.321	-0.387	0.000	0.000	-0.975	-0.286
OCCUPANTS TO SPACE	27.009	7.910	46.875	13.729	47.028	13.773
LIGHT TO SPACE	104.108	30.491	0.000	0.000	26.734	7.830
EQUIPMENT TO SPACE	96.808	28.353	0.000	0.000	16.306	4.776
PROCESS TO SPACE	0.000	0.000	0.000	0.000	0.000	0.000
INFILTRATION	188.739	55.277	318.441	93.264	-197.574	-57.865
TOTAL	644.316	188.704	365.316	106.992	-240.350	-70.393
TOTAL LOAD	1009.632 KBTU/H		295.696 KW		-240.350 KBTU/H	-70.393 KW
TOTAL LOAD / AREA	72.33BTU/H.SQFT		228.034 W /SQMT		17.220BTU/H.SQFT	54.285 W /SQMT

NOTE
1) THE ABOVE LOADS EXCLUDE OUTSIDE VENTILATION AIR LOADS
2) TIMES GIVEN IN STANDARD TIME FOR THE LOCATION IN CONSIDERATION

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EMC        ENGINEERS      INC.          EZDOE - ELITE SOFTWARE DEVELOPMENT INC        DOE-2.1D   2/27/1995     16:50:36   SDL RUN 1
DENVER,        CO         80227         EXISTING SIMULATION FOR BLDG. 7404      ENL MEN BARRACKS W/O DIN
REPORT- SS-A   SYSTEM MONTHLY LOADS SUMMARY FOR              MULTIZONE                    TOPEKA, KS
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MONTH	COOLING ENERGY (MBTU)	COOLING TIME OF MAX DY	COOLING TIME OF MAX HR	COOLING DRY-BULB TEMP	COOLING WET-BULB TEMP	MAXIMUM COOLING LOAD (KBTU/HR)	HEATING ENERGY (MBTU)	HEATING TIME OF MAX DY	HEATING TIME OF MAX HR	HEATING DRY-BULB TEMP	HEATING WET-BULB TEMP	MAXIMUM HEATING LOAD (KBTU/HR)	ELEC- TRICAL ENERGY (KWH)	MAXIMUM ELEC LOAD (KW)
MAY	161.81717	16	2	62.F	59.F	1134.931	-0.288	15	10	70.F	67.F	-49.900	27523.	98.953
JUN	354.96619	19	19	86.F	75.F	916.070	0.000					0.000	48571.	98.953
JUL	416.69571	2	19	84.F	77.F	899.956	0.000					0.000	50190.	98.953
AUG	410.92154	24	19	92.F	76.F	962.199	0.000					0.000	50190.	98.953
SEP	276.45010	5	17	90.F	77.F	956.819	0.000					0.000	48571.	98.953
OCT	6.72422	1	18	83.F	68.F	581.717	0.000					0.000	1619.	98.953
TOTAL	1627.575						-0.288						226666.	
MAX						1134.931						-49.900		98.953

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EMC        ENGINEERS      INC.          EZDOE - ELITE SOFTWARE DEVELOPMENT INC        DOE-2.1D   2/27/1995     16:50:36   SDL RUN 1
DENVER,        CO         80227         EXISTING SIMULATION FOR BLDG. 7404      ENL MEN BARRACKS W/O DIN
REPORT- SS-C   SYSTEM MONTHLY LOAD HOURS FOR                 MULTIZONE                    TOPEKA, KS
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MONTH	HOURS COOLING LOAD	HOURS HEATING LOAD	HOURS COINCIDENT COOL-HEAT LOAD	HOURS FLOATING	HOURS HEATING AVAIL.	HOURS COOLING AVAIL.	HOURS FANS ON	HOURS FANS CYCLE ON	HOURS NIGHT VENTING	HOURS FLOATING WHEN FANS ON	COINCIDENT LOADS: HEATING LOAD AT COOLING PEAK (KBTU/HR)	COINCIDENT LOADS: ELECTRIC LOAD AT COOLING PEAK (KW)
MAY	384	24	0	0	24	384	408	0	0	0	0.000	33.650
JUN	720	0	0	0	0	720	720	0	0	0	0.000	98.953
JUL	744	0	0	0	0	744	744	0	0	0	0.000	98.953
AUG	744	0	0	0	0	744	744	0	0	0	0.000	98.953
SEP	718	0	0	2	0	720	720	0	0	2	0.000	80.199
OCT	24	0	0	0	0	24	24	0	0	0	0.000	98.953
ANNUAL	3334	24	0	2	24	3336	3360	0	0	2		

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EMC          ENGINEERS       INC.        EZDOE - ELITE SOFTWARE DEVELOPMENT INC        DOE-2.1D   2/27/1995     16:50:36  PDL RUN 1
DENVER,         CO          80227        EXISTING SIMULATION FOR BLDG. 7404       ENL MEN BARRACKS W/O DIN
REPORT- PS-B MONTHLY PEAK AND TOTAL ENERGY USE                                          TOPEKA, KS
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MO	UTILITY-	ELECTRICITY	NATURAL-GAS
	TOTAL (MBTU)	151.589	0.393
MAY	PEAK (KBTU)	655.699	62.791
	DY/HR	30/18	15/10
	TOTAL (MBTU)	292.314	0.000
JUN	PEAK (KBTU)	655.320	0.000
	DY/HR	19/19	30/ 1
	TOTAL (MBTU)	318.959	0.000
JUL	PEAK (KBTU)	676.933	0.000
	DY/HR	23/18	31/ 1
	TOTAL (MBTU)	322.331	0.000
AUG	PEAK (KBTU)	686.085	0.000
	DY/HR	24/18	31/ 1
	TOTAL (MBTU)	268.994	0.000
SEP	PEAK (KBTU)	674.782	0.000
	DY/HR	5/18	30/ 1
	TOTAL (MBTU)	8.206	0.000
OCT	PEAK (KBTU)	575.078	0.000
	DY/HR	1/18	1/ 1
	ONE YEAR	1362.394	0.393
	USE/PEAK	686.085	62.791


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EMC          ENGINEERS       INC.        EZDOE - ELITE SOFTWARE DEVELOPMENT INC        DOE-2.1D   2/27/1995     16:50:36  PDL RUN 1
DENVER,         CO          80227        EXISTING SIMULATION FOR BLDG. 7404       ENL MEN BARRACKS W/O DIN
REPORT- BEPS ESTIMATED BUILDING ENERGY PERFORMANCE                                      TOPEKA, KS
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ENERGY TYPE IN SITE MBTU - CATEGORY OF USE	ELECTRICITY	NATURAL-GAS
SPACE HEAT	0.01	0.39
SPACE COOL	546.36	0.00
HVAC AUX	385.11	0.00
DOM HOT WTR	0.00	0.00
AUX SOLAR	0.00	0.00
LIGHTS	234.87	0.00
VERT TRANS	0.00	0.00
MISC EQUIP	196.04	0.00
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TOTAL	1362.38	0.39

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TOTAL SITE ENERGY       1362.79 MBTU     32.5 KBTU/SQFT-YR GROSS-AREA     97.6 KBTU/SQFT-YR NET-AREA
TOTAL SOURCE ENERGY     4091.67 MBTU     97.7 KBTU/SQFT-YR GROSS-AREA    293.1 KBTU/SQFT-YR NET-AREA
PERCENT OF HOURS ANY SYSTEM ZONE OUTSIDE OF THROTTLING RANGE =  0.9
PERCENT OF HOURS ANY PLANT LOAD NOT SATISFIED                =  0.0
NOTE   ELECTRICITY AND/OR FUEL USED TO GENERATE ELECTRICITY IS APPORTIONED BASED
       ON THE YEARLY DEMAND.  ALL OTHER ENERGY TYPES ARE APPORTIONED HOURLY.
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EMC ENGINEERS INC. EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/22/1995 13:31:29 SDL RUN 1
DENVER, CO 80227 PROPOSED MODIFICATION OF BLDG. 7404 ENL MEN BARRACKS W/O DIN
REPORT- SS-A SYSTEM MONTHLY LOADS SUMMARY FOR MULTIZONE TOPEKA, KS

	COOLING						HEATING						ELEC	
MONTH	COOLING ENERGY (MBTU)	TIME OF MAX DY	TIME OF MAX HR	DRY-BULB TEMP	WET-BULB TEMP	MAXIMUM COOLING LOAD (KBTU/HR)	HEATING ENERGY (MBTU)	TIME OF MAX DY	TIME OF MAX HR	DRY-BULB TEMP	WET-BULB TEMP	MAXIMUM HEATING LOAD (KBTU/HR)	ELEC-TRICAL ENERGY (KWH)	MAXIMUM ELEC LOAD (KW)
MAY	118.78535	30	18	86.F	75.F	866.743	-0.033	15	21	72.F	66.F	-16.410	17712.	93.788
JUN	281.88159	19	19	86.F	75.F	900.604	0.000					0.000	32504.	96.036
JUL	344.92856	23	18	95.F	79.F	882.972	0.000					0.000	34718.	98.602
AUG	343.75177	24	19	92.F	76.F	969.348	0.000					0.000	35291.	98.923
SEP	199.53497	5	18	90.F	77.F	942.876	0.000					0.000	30834.	97.697
OCT	3.94326	1	18	83.F	68.F	448.498	0.000					0.000	988.	78.754
TOTAL	1292.827						-0.033						152047.	
MAX						969.348						-16.410		98.923

EMC ENGINEERS INC. EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/22/1995 13:31:29 SDL RUN 1
DENVER, CO 80227 PROPOSED MODIFICATION OF BLDG. 7404 ENL MEN BARRACKS W/O DIN
REPORT- SS-C SYSTEM MONTHLY LOAD HOURS FOR MULTIZONE TOPEKA, KS

	NUMBER OF HOURS										COINCIDENT LOADS	
MONTH	HOURS COOLING LOAD	HOURS HEATING LOAD	HOURS COINCIDENT COOL-HEAT LOAD	HOURS FLOATING	HOURS HEATING AVAIL.	HOURS COOLING AVAIL.	HOURS FANS ON	HOURS FANS CYCLE ON	HOURS NIGHT VENTING	HOURS FLOATING WHEN FANS ON	HEATING LOAD AT COOLING PEAK (KBTU/HR)	ELECTRIC LOAD AT COOLING PEAK (KW)
MAY	384	24	0	0	24	384	408	0	0	0	0.000	92.433
JUN	720	0	0	0	0	720	720	0	0	0	0.000	96.036
JUL	744	0	0	0	0	744	744	0	0	0	0.000	98.192
AUG	744	0	0	0	0	744	744	0	0	0	0.000	98.877
SEP	720	0	0	0	0	720	720	0	0	0	0.000	96.651
OCT	24	0	0	0	0	24	24	0	0	0	0.000	78.754
ANNUAL	3336	24	0	0	24	3336	3360	0	0	0		

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EMC      ENGINEERS      INC.       EZDOE - ELITE SOFTWARE DEVELOPMENT INC        DOE-2.1D   2/22/1995      13:31:29  PDL RUN 1
DENVER,     CO         80227       PROPOSED MODIFICATION OF BLDG. 7404      ENL MEN BARRACKS W/O DIN
REPORT- PS-B  MONTHLY PEAK AND TOTAL ENERGY USE                                      TOPEKA, KS
```

MO	UTILITY-	ELECTRICITY	NATURAL-GAS
	TOTAL(MBTU)	105.473	0.049
MAY	PEAK(KBTU)	603.061	20.649
	DY/HR	30/18	15/21
	TOTAL(MBTU)	214.473	0.000
JUN	PEAK(KBTU)	621.643	0.000
	DY/HR	19/19	30/ 1
	TOTAL(MBTU)	241.729	0.000
JUL	PEAK(KBTU)	654.195	0.000
	DY/HR	23/18	31/ 1
	TOTAL(MBTU)	247.745	0.000
AUG	PEAK(KBTU)	662.997	0.000
	DY/HR	24/18	31/ 1
	TOTAL(MBTU)	184.054	0.000
SEP	PEAK(KBTU)	644.015	0.000
	DY/HR	5/18	30/ 1
	TOTAL(MBTU)	5.132	0.000
OCT	PEAK(KBTU)	421.177	0.000
	DY/HR	1/18	1/ 1
	ONE YEAR	998.606	0.049
	USE/PEAK	662.997	20.649

D3-40

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EMC      ENGINEERS      INC.       EZDOE - ELITE SOFTWARE DEVELOPMENT INC        DOE-2.1D   2/22/1995      13:31:29  PDL RUN 1
DENVER,     CO         80227       PROPOSED MODIFICATION OF BLDG. 7404      ENL MEN BARRACKS W/O DIN
REPORT- BEPS  ESTIMATED BUILDING ENERGY PERFORMANCE                                  TOPEKA, KS
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ENERGY TYPE IN SITE MBTU - CATEGORY OF USE	ELECTRICITY	NATURAL-GAS
SPACE HEAT	0.00	0.05
SPACE COOL	443.48	0.00
HVAC AUX	124.22	0.00
DOM HOT WTR	0.00	0.00
AUX SOLAR	0.00	0.00
LIGHTS	234.87	0.00
VERT TRANS	0.00	0.00
MISC EQUIP	196.04	0.00
	----------	----------
TOTAL	998.60	0.05

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TOTAL SITE ENERGY        998.66 MBTU     23.8 KBTU/SQFT-YR GROSS-AREA     71.5 KBTU/SQFT-YR NET-AREA
TOTAL SOURCE ENERGY     2998.87 MBTU     71.6 KBTU/SQFT-YR GROSS-AREA    214.9 KBTU/SQFT-YR NET-AREA
PERCENT OF HOURS ANY SYSTEM ZONE OUTSIDE OF THROTTLING RANGE =  4.5
PERCENT OF HOURS ANY PLANT LOAD NOT SATISFIED                =  0.1
NOTE  ELECTRICITY AND/OR FUEL USED TO GENERATE ELECTRICITY IS APPORTIONED BASED
      ON THE YEARLY DEMAND.  ALL OTHER ENERGY TYPES ARE APPORTIONED HOURLY.
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BUILDINGS 7612, 7614, 7616, 7810, 7814
ANNUAL ENERGY SAVINGS SUMMARY

(PER BUILDING)

Item	Baseline	ECO	Annual Energy Savings	Adj. Annual Energy Savings*
Annual Electric (MBTU)	1951.46	1856.36	95.10	95.10
Annual Natural Gas (MBTU)	3450.29	1274.67	2175.62	2175.62
Electric Demand June (KW)	149.08	167.37	-18.29	-18.29
Electric Demand July (KW)	155.78	179.18	-23.40	-23.40
Electric Demand August (KW)	156.02	179.66	-23.65	-23.65

*Energy savings prorated on a square foot basis:

Baseline Model Bldg 7612 (sq.ft.)	41892
ECO Model Bldg 7612 (sq.ft.)	41892
Square Footage Adjustment Factor	1.000

LIFE CYCLE COST ANALYSIS SUMMARY
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

LOCATION:	Fort Riley	REGION: 2 (Kansas)		PROJECT NO:	1406-005
PROJECT TITLE:	Feasibility Study for HVAC Upgrade			FISCAL YEAR:	1995
ANALYSIS DATE:	05/04/95	ECONOMIC LIFE:	20	PREPARED BY:	C. Wohlert

1. INVESTMENT: **BLDG 7612 - Replace Fan Coils w/ 6 VAV AHUs**

A.	CONSTRUCTION COST	=	$389,740	
B.	SIOH COST	(5.5% of 1A) =	$21,436	
C.	DESIGN COST	(6.0% of 1A) =	$23,384	
D.	TOTAL COST	(1A +1B +1C) =	$434,560	
E.	SALVAGE VALUE OF EXISTING EQUIPMENT =		$0	
F.	PUBLIC UTILITY COMPANY REBATE =		$0	
G.	TOTAL INVESTMENT	(1D -1E -1F) =	------->	$434,560

2. ENERGY SAVINGS (+) OR COST (-):

DATE OF NISTR 85-3273-9 USED FOR DISCOUNT FACTORS: JAN '95

	ENERGY SOURCE	FUEL COST $/MBTU (1)	SAVINGS MBTU/YR (2)	ANNUAL $ SAVINGS (3)	DISCOUNT FACTOR (4)	DISCOUNTED SAVINGS (5)	
A.	ELECT.	$12.10	95	$1,151	15.88	$18,273	
B.	DIST	$0.00	0	$0	19.16	$0	
C.	NAT GAS	$4.12	2,176	$8,964	18.30	$164,033	
D.	COAL	$0.00	0	$0	16.62	$0	
E.	ELEC. DEMAND			($1,233)	14.88	($18,347)	
F.	TOTAL		2,271	$8,881		-------->	$163,959

3. NON-ENERGY SAVINGS (+) OR COST (-)

A. ANNUAL RECURRING (+/-)

1 ANNUAL MAINTENANCE	$5,147	14.88	$76,588
2	$0	14.88	$0
3	$0	14.88	$0
4 TOTAL ANNUAL DISC. SAVINGS (+) / COST	$5,147		$76,588

B. NON-RECURRING (+/-)

ITEM	SAVINGS (+) COST(-) (1)	YEAR OF OCCURRENCE (2)	DISCOUNT FACTOR (3) (TABLE A-2)	DISCOUNTED SAVINGS/COST (4)
a. BASELINE EQUIP. REPLCMNT.	$179,196	5	0.863	$154,646
b.				$0
c.				$0
d.				$0
e.				$0
f. TOTAL	$179,196			$154,646

C. TOTAL NON-ENERGY DISCOUNTED SAVINGS (+) OR COST (-) (3A4 + 3Bf4) = $231,234

4.	FIRST YEAR DOLLAR SAVINGS (+) / COSTS (-)	(2F3+3A4+(3Bf1/Economic Life))	$22,988
5.	SIMPLE PAYBACK (SPB) IN YEARS (MUST BE < 10 YEARS TO QUALIFY)	(1G/4) =	18.90
6.	TOTAL NET DISCOUNTED SAVINGS	(2F5 + 3C) =	$395,193
7.	DISCOUNTED SAVINGS-TO-INVESTMENT RATIO (SIR) (MUST HAVE SIR > 1.25 TO QUALIFY)	(6/1G) =	0.91

ENGINEER'S OPINION OF PROBABLE COST

PROJECT	Fort Riley Feasibility Study for HVAC Upgrade	SHEET 1 OF 1	
ENGINEER	E M C Engineers, Inc. Denver, CO	DATE PREPARED	4-May-95
		ESTIMATOR	C. Wohlert
		CHECKED BY	A. Niemeyer

Line No.	Item Refer Code	Item Description	Unit of Measure	MATERIAL COST Quantity	MATERIAL COST Unit Cost	MATERIAL COST Total	LABOR COST Crew/ Worker	LABOR COST Hours/ Unit	LABOR COST Total	TOTAL
1		**BUILDING 7612**								
2		**PROPOSED SYSTEM MODIFICATIONS**								
3		*NEW SYSTEMS INSTALLATION*								
4	AHUH540	5,400 CFM AHU, COMBINATION COIL	EA.	6.0	$4,563.99	$27,384	Q-6	31.5	$3,800	$31,184
5	DUCT500	GAL. STEEL DUCTWORK	LB.	16600.0	$0.45	$7,399	Q-10	0.087	$28,058	$35,458
6	12"RDUC	12 IN. DIA. ROUND DUCT, GAL. STL	L.F.	120.0	$2.73	$328	Q-9	0.133	$299	$627
7	8"RDUCT	8 IN. DIA. ROUND DUCT, GAL. STL	L.F.	900.0	$1.79	$1,613	Q-9	0.08	$1,350	$2,963
8	6"RDUCT	6 IN. DIA. ROUND DUCT, GAL. STL	L.F.	168.0	$1.37	$230	Q-9	0.057	$179	$409
9	DTINSL0.	0.5" FIBERGLASS LINER, 2LB DENSITY	S.F.	8330.0	$0.37	$3,067	Q-14	0.042	$6,443	$9,510
10	9X9DIFF	9X9 SA DIFFUSERS	EA.	42.0	$56.69	$2,381	1-SHEE	0.571	$499	$2,880
11	12X6SA	12X6 SA GRILLES	EA.	84.0	$9.84	$826	1-SHEE	0.348	$608	$1,435
12	14X6SA	14X6 RA GRILLES	EA.	84.0	$10.85	$912	1-SHEE	0.348	$608	$1,520
13	STLPIP4	STEEL PIPE SCH. 40, 4" W/HANGERS	L.F.	800.0	$9.16	$7,326	Q-15	0.432	$6,701	$14,027
14	STLPIP2.5	STEEL PIPE SCH. 40, 2.5" W/HANGERS	L.F.	960.0	$5.28	$5,070	Q-15	0.34	$6,329	$11,399
15		VALVES AND FITTINGS ADD 15%				$1,859			$1,955	$3,814
16	INSLPIP4	4" FIBERGLASS PIPE INSULATION, 1.5" THCK	L.F.	800.0	$1.89	$1,512	Q-14	0.114	$1,680	$3,191
17	INSLPIP2.	2.5" FIBERGLASS PIPE INSULATION, 1.5" THCK	L.F.	960.0	$1.60	$1,535	Q-14	0.089	$1,573	$3,108
18	10"VAVDP	10" VAV ROUND MOTORIZED DAMPER, ELEC	EA.	78.0	$300.87	$23,468	1-SHEE	0.444	$721	$24,189
19	VSD5	VARIABLE SPEED DRIVE W/ CONTRLER,5HP	EA.	6.0	$2,444.79	$14,669	1-ELEC	10.5	$1,318	$15,987
20	E-TSTAT1	SINGLE SETPOINT ELEC. TSTAT, 3 WIRE	EA.	78.0	$24.23	$1,890	1-ELEC	0.8	$1,306	$3,195
21	ELCND1	ELECTRICAL CONDUIT 1"	L.F.	500.0	$0.83	$417	1-ELEC	0.064	$670	$1,086
22	WIRE#6	COPPER WIRING #6	C.L.F.	25.0	$24.71	$618	1-ELEC	1.231	$644	$1,262
23	PMP3HP	PUMP, 3 HP	EA	2.0	$944.78	$1,890	Q-1	6.975	$270	$2,160
24	PMP5HP	PUMP, 5 HP	EA	2.0	$1,114.35	$2,229	Q-1	8.889	$345	$2,573
25										
26		*EXISTING SYSTEMS DEMOLITION*								
27		FAN COIL DEMOLITION	E.A.	92.0			Q-5	0.5	$3,122	$3,122
28		DUAL TEMP. WATER PIPING DEMOLITION	L.F.	3300.0			1-PLUM	0.04	$2,843	$2,843
29		3-SPEED FAN SWITCH DEMOLITION	EA.	92.0			Q-5	0.44	$2,747	$2,747
30		ASBESTOS REMOVAL	L.S.	1.0						$72,100
31		**SUBTOTAL**				$106,620			$74,069	$252,789
32	OH	OVERHEAD			17%	$17,912			$12,444	$42,469
33	PRO	PROFIT			10%	$12,453			$8,651	$29,526
34	CONT	CONTINGENCY			20%	$27,397			$19,033	$64,957
35	**TOTAL COST**		-	-	-	$164,383	-	-	$114,196	$389,740

ENGINEER'S OPINION OF PROBABLE COST

PROJECT	Fort Riley Feasibility Study for HVAC Upgrade	**SHEET** 1 **OF** 1	
		DATE PREPARED	4-May-95
ENGINEER	E M C Engineers, Inc.	**ESTIMATOR**	C. Wohlert
	Denver, CO	**CHECKED BY**	A. Niemeyer

Line No.	Item Refer Code	Item Description	Unit of Measure	MATERIAL COST Quantity	MATERIAL COST Unit Cost	MATERIAL COST Total	LABOR COST Crew/ Worker	LABOR COST Hours/ Unit	LABOR COST Total	TOTAL
1		**BUILDING 7612**								
2		**NON-RECURRING**								
3										
4		*BASELINE - EXISTING EQUIP. REPLACEMENT*								
5	FC-1TON	FAN COIL, CW, CABINET, 1 TON	EA.	92.0	$673.46	$61,958	Q-6	2.667	$4,933	$66,891
6	CUPIP0.7	COPPER PIPE TYPE L, 0.75" W/HANGERS	L.F.	2400.0	$1.84	$4,419	1-PLUM	0.105	$5,427	$9,846
7		VALVES AND FITTINGS ADD 15%				$663			$814	$1,477
8	CUPIP2	COPPER PIPE TYPE L, 2" W/HANGERS	L.F.	600.0	$5.96	$3,576	1-PLUM	0.19	$2,455	$6,031
9		VALVES AND FITTINGS ADD 15%				$536			$368	$905
10	CUPIP3	COPPER PIPE TYPE L, 3" W/HANGERS	L.F.	300.0	$11.19	$3,358	Q-1	0.286	$1,664	$5,021
11		VALVES AND FITTINGS ADD 15%				$504			$250	$753
12	INSLPIP0.	0.75" FIBERGLASS PIPE INSULATION, 1" THCK	L.F.	2400.0	$0.61	$1,465	Q-14	0.07	$3,094	$4,559
13	INSLPIP2	2" FIBERGLASS PIPE INSULATION, 1.5" THCK	L.F.	600.0	$1.46	$878	Q-14	0.084	$928	$1,806
14	INSLPIP3	3" FIBERGLASS PIPE INSULATION, 1.5" THCK	L.F.	300.0	$1.66	$497	Q-14	0.094	$519	$1,016
15	PMP3HP	PUMP, 3 HP	EA	1.0	$944.78	$945	Q-1	6.975	$135	$1,080
16	PMP2ND	PUMP, 2 HP, NO DEMO	EA	1.0	$867.26	$867	Q-1	5.333	$103	$971
17	PMP1.5HP	PUMP, 1.5 HP	EA	2.0	$843.03	$1,686	Q-1	5.333	$207	$1,893
18	3SWTCH	3-SPEED FAN SWITCH	EA.	92.0	$14.54	$1,337	1-ELEC	0.667	$1,284	$2,621
19	AHUH320	3,200 CFM AHU	EA.	2.0	$3,023.28	$6,047	Q-5	21	$814	$6,861
20		*EXISTING SYSTEMS DEMOLITION*								
21		FAN COIL DEMOLITION	TON	3.5			Q-5	14.545	$987	$987
22		DUAL TEMP. WATER PIPING DEMOLITION	L.F.	3300.0			1-PLUM	0.04	$2,843	$2,843
23		3-SPEED FAN SWITCH DEMOLITION	EA.	92.0			Q-5	0.2	$357	$357
24		DUAL TEMP. WATER PUMP DEMOLITION	EA.	4.0			Q-5	4	$310	$310
25										
26										
27										
28										
29										
30										
31		**SUBTOTAL**				$88,734			$27,493	$116,228
32	OH	OVERHEAD			17%	$14,907			$4,619	$19,526
33	PRO	PROFIT			10%	$10,364			$3,211	$13,575
34	CONT	CONTINGENCY			20%	$22,801			$7,065	$29,866
35	**TOTAL COST**		-	-	-	$136,807	-	-	$42,388	$179,196

ENGINEER'S OPINION OF PROBABLE COST

PROJECT	Fort Riley Feasibility Study for HVAC Upgrade	SHEET	1 OF 1
ENGINEER	E M C Engineers, Inc.	DATE PREPARED	4-May-95
	Denver, CO	ESTIMATOR	C. Wohlert
		CHECKED BY	A. Niemeyer

Line No.	Item Refer Code	Item Description	Unit of Measure	MATERIAL COST Quantity	MATERIAL COST Unit Cost	MATERIAL COST Total	LABOR COST Crew/ Worker	LABOR COST Hours/ Unit	LABOR COST Total	TOTAL
1		**BUILDING 7612**								
2		***ANNUAL RECURRING***								
3		***ANNUAL MAINTENANCE COST - BASELINE***								
4	MNT-FCs	MAINT. ON FCs - INSPEC. / YR	EA.	92.0	$0.00	$0	Q-6	4	$7,399	$7,399
5	MNT-AHU	MAINT. ON AHU - INSPEC. / YR <= 5000 CFM	EA.	2.0	$0.00	$0	Q-6	19	$764	$764
6										
7										
8										
9										
10										
11										
12										
13										
14										
15	**TOTAL ANNUAL MAINTENANCE COST - BASELINE**		-	-	-	$0	-	-	$8,163	$8,163
16										
17		***ANNUAL MAINTENANCE COST - NEW HVAC REPLACEMENT***								
18	MNT-AHU	MAINT. ON AHU - INSPEC. / YR > 5000 CFM	EA.	6.0			Q-6	25	$3,016	$3,016
19										
20										
21										
22										
23										
24										
25										
26										
27										
28										
29	**TOTAL ANNUAL MAINTENANCE COST - BASELINE**		-	-	-	$0	-	-	$3,016	$3,016
30										
31										
32										
33										
34										
35	**TOTAL ANNUAL MAINTENANCE COST SAVINGS**		-	-	-	$0	-	-	$5,147	$5,147

DEMAND LIMITING ANALYSIS BUILDING 7612

SUMMER PEAK (KW) = 27812	1993 JUL BILL 7/1-8/2 ACTUAL	1993 AUG BILL 8/2-9/1 ACTUAL	1993 SEP BILL 9/3-10/1 ACTUAL	1993 OCT BILL 10/1-11/1 ACTUAL	1993 NOV BILL 11/1-12/1 ACTUAL	1993 DEC BILL 12/1-1/3 ACTUAL	1993 JAN BILL 1/4-2/1 ACTUAL	1993 FEB BILL 2/1-3/1 ACTUAL	1993 MAR BILL 3/3-4/1 ACTUAL	1993 APR BILL 4/1-5/3 ACTUAL	1993 MAY BILL 5/3-6/1 ACTUAL	1993 JUN BILL 6/1-7/1 ACTUAL
BASE CASE												
CAPACITY (KW)	32472	34452	26136	20754	26400	22752	27108	25812	23310	21834	21996	30096
POWER FACTOR (%)	99.20%	99.10%	99.10%	99.90%	99.80%	99.70%	99.50%	99.60%	99.60%	99.80%	99.60%	98.80%
CAPACITY (KVA)	32734	34765	26373	20775	26453	22820	27244	25916	23404	21878	22084	30462
80% SUMMER PEAK (KVA)	27812	27812	27812	27812	27812	27812	27812	27812	27812	27812	27812	27812
CONTRACT MINIMUM (KVA)	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643
BILLING CAPACITY (KVA)	32734	34765	27812	27812	27812	27812	27812	27812	27812	27812	27812	30462
ACTUAL OR 80% PEAK	ACTUAL	ACTUAL	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	ACTUAL
200 KVA @ $4.45	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00
NEXT 400 @ $4.25	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00
REMAINING @ $4.05	$130,142.18	$138,367.78	$110,208.22	$110,208.22	$110,208.22	$110,208.22	$110,208.22	$110,208.22	$110,208.22	$110,208.22	$110,208.22	$120,939.23
SUB DISCOUNT $.20	($6,546.77)	($6,952.98)	($5,562.38)	($5,562.38)	($5,562.38)	($5,562.38)	($5,562.38)	($5,562.38)	($5,562.38)	($5,562.38)	($5,562.38)	($6,092.31)
CAPACITY CHARGE	$126,185.40	$134,004.80	$107,235.84	$107,235.84	$107,235.84	$107,235.84	$107,235.84	$107,235.84	$107,235.84	$107,235.84	$107,235.84	$117,436.92
TOTAL ENERGY (KWH)	16,920,000	16,200,000	10,980,000	10,140,000	11,160,000	12,930,000	12,600,000	12,270,000	12,480,000	11,070,000	9,720,000	13,170,000
50*KVA @ $.03924	$64,223.85	$68,208.70	$54,566.96	$54,566.96	$54,566.96	$54,566.96	$54,566.96	$54,566.96	$54,566.96	$54,566.96	$54,566.96	$59,765.54
100*KVA @ $.03404	$111,426.10	$118,339.66	$94,671.73	$94,671.73	$94,671.73	$94,671.73	$94,671.73	$94,671.73	$94,671.73	$94,671.73	$94,671.73	$103,691.08
250*KVA @ $.03084	$252,378.15	$268,037.26	$209,965.32	$184,059.72	$214,429.80	$214,429.80	$214,429.80	$214,429.80	$214,429.80	$212,740.92	$171,106.92	$234,858.46
EXCESS @ $.02864	$109,589.57	$65,701.49	$0.00	$0.00	$1,009.19	$51,701.99	$42,250.79	$32,799.59	$38,813.99	$0.00	$0.00	$28,221.42
ENERGY CHARGE	$537,617.67	$520,287.11	$359,204.01	$333,298.41	$364,677.69	$415,370.49	$405,919.29	$396,468.09	$402,482.49	$361,979.61	$320,345.61	$426,536.49
TOTAL CHARGE LESS ECA	$663,803.07	$654,291.92	$466,439.85	$440,534.25	$471,913.53	$522,606.33	$513,155.13	$503,703.93	$509,718.33	$469,215.45	$427,581.45	$543,973.42
DEMAND REDUCTION (KW)	**(23.40)**	**(23.65)**	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**(18.29)**
CAPACITY (KW)	32495	34476	26136	20754	26400	22752	27108	25812	23310	21834	21996	30114
POWER FACTOR (%)	99.20%	99.10%	99.10%	99.90%	99.80%	99.70%	99.50%	99.60%	99.60%	99.80%	99.60%	98.80%
CAPACITY (KVA)	32757	34789	26373	20775	26453	22820	27244	25916	23404	21878	22084	30480
80% SUMMER PEAK (KVA)	27831	27831	27831	27831	27831	27831	27831	27831	27831	27831	27831	27831
CONTRACT MINIMUM (KVA)	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643
BILLING CAPACITY (KVA)	32757	34789	27831	27831	27831	27831	27831	27831	27831	27831	27831	30480
ACTUAL OR 80% PEAK	ACTUAL	ACTUAL	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	ACTUAL
200 KVA @ $4.45	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00
NEXT 400 @ $4.25	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00
REMAINING @ $4.05	$130,237.73	$138,464.42	$110,285.54	$110,285.54	$110,285.54	$110,285.54	$110,285.54	$110,285.54	$110,285.54	$110,285.54	$110,285.54	$121,014.19
SUB DISCOUNT $.20	($6,551.49)	($6,957.75)	($5,566.20)	($5,566.20)	($5,566.20)	($5,566.20)	($5,566.20)	($5,566.20)	($5,566.20)	($5,566.20)	($5,566.20)	($6,096.01)
CAPACITY CHARGE	$126,276.24	$134,096.67	$107,309.34	$107,309.34	$107,309.34	$107,309.34	$107,309.34	$107,309.34	$107,309.34	$107,309.34	$107,309.34	$117,508.18
TOTAL ENERGY (KWH)	16,920,000	16,200,000	10,980,000	10,140,000	11,160,000	12,930,000	12,600,000	12,270,000	12,480,000	11,070,000	9,720,000	13,170,000
50*KVA @ $.03924	$64,270.14	$68,255.52	$54,604.42	$54,604.42	$54,604.42	$54,604.42	$54,604.42	$54,604.42	$54,604.42	$54,604.42	$54,604.42	$59,801.85
100*KVA @ $.03404	$111,506.41	$118,420.89	$94,736.71	$94,736.71	$94,736.71	$94,736.71	$94,736.71	$94,736.71	$94,736.71	$94,736.71	$94,736.71	$103,754.08
250*KVA @ $.03084	$252,560.05	$268,221.23	$209,877.01	$183,971.41	$214,576.99	$214,576.99	$214,576.99	$214,576.99	$214,576.99	$212,652.61	$171,018.61	$235,001.16
EXCESS @ $.02864	$109,319.30	$65,428.12	$0.00	$0.00	$790.50	$51,483.30	$42,032.10	$32,580.90	$38,595.30	$0.00	$0.00	$28,009.39
ENERGY CHARGE	$537,655.89	$520,325.77	$359,218.14	$333,312.54	$364,708.62	$415,401.42	$405,950.22	$396,499.02	$402,513.42	$361,993.74	$320,359.74	$426,566.48
TOTAL CHARGE LESS ECA	$663,932.13	$654,422.44	$466,527.48	$440,621.88	$472,017.95	$522,710.75	$513,259.55	$503,808.35	$509,822.75	$469,303.08	$427,669.08	$544,074.65
SUMMARY												
MONTHLY DIFFERENCE	($129.05)	($130.53)	($87.62)	($87.62)	($104.42)	($104.42)	($104.42)	($104.42)	($104.42)	($87.62)	($87.62)	($101.24)
ANNUAL DIFFERENCE.............		**($1,233)**										

NUMBER OF EXTERIOR SURFACES 9 RECTANGULAR 9 OTHER 0
(U-VALUE INCLUDES INSIDE AIR FILM PLUS OUTSIDE AIR FILM AT 7.5 MPH WINDSPEED)

SURFACE	SPACE	- - - - G L A S S - - - - U-VALUE (BTU/HR-SQFT-F)	AREA (SQFT)	- - - - W A L L - - - - U-VALUE (BTU/HR-SQFT-F)	AREA (SQFT)	- W A L L + G L A S S - U-VALUE (BTU/HR-SQFT-F)	AREA (SQFT)	AZIMUTH
	EXTER-N	0.487	2205.00	0.258	6315.00	0.317	8520.00	NORTH
	EXTER-E	0.487	35.10	0.258	1665.90	0.263	1701.00	EAST
	EXTER-S	0.487	2205.00	0.258	6315.00	0.317	8520.00	SOUTH
	EXTER-W	0.487	35.10	0.258	1665.90	0.263	1701.00	WEST
	EXTER-S	0.000	0.00	0.064	4985.00	0.064	4985.00	ROOF
	EXTER-N	0.000	0.00	0.064	4560.00	0.064	4560.00	ROOF
	EXTER-E	0.000	0.00	0.064	805.00	0.064	805.00	ROOF
	inter-zone	0.000	0.00	0.064	2803.00	0.064	2803.00	ROOF
	EXTER-W	0.000	0.00	0.064	805.00	0.064	805.00	ROOF
	inter-zone	0.000	0.00	0.020	2803.00	0.020	2803.00	UNDERGRND
	EXTER-N	0.000	0.00	0.020	4560.00	0.020	4560.00	UNDERGRND
	EXTER-S	0.000	0.00	0.020	4985.00	0.020	4985.00	UNDERGRND
	EXTER-E	0.000	0.00	0.020	805.00	0.020	805.00	UNDERGRND
	EXTER-W	0.000	0.00	0.020	805.00	0.020	805.00	UNDERGRND

EMC ENGINEERS INC. EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/27/1995 16:44:58 LDL RUN 1
DENVER, CO 80227 EXISTING CONDITION OF BLDG. 7612 ENL BARRACKS W/AS
REPORT- LV-D DETAILS OF EXTERIOR SURFACES IN THE PROJECT TOPEKA, KS

	AVERAGE U-VALUE/GLASS (BTU/HR-SQFT-F)	AVERAGE U-VALUE/WALLS (BTU/HR-SQFT-F)	AVERAGE U-VALUE WALLS+GLASS (BTU/HR-SQFT-F)	GLASS AREA (SQFT)	OPAQUE AREA (SQFT)	GLASS+OPAQUE AREA (SQFT)
NORTH	0.487	0.258	0.317	2205.00	6315.00	8520.00
EAST	0.487	0.258	0.263	35.10	1665.90	1701.00
SOUTH	0.487	0.258	0.317	2205.00	6315.00	8520.00
WEST	0.487	0.258	0.263	35.10	1665.90	1701.00
ROOF	0.000	0.064	0.064	0.00	13958.00	13958.00
ALL WALLS	0.487	0.258	0.308	4480.20	15961.80	20442.00
WALLS+ROOFS	0.487	0.167	0.209	4480.20	29919.80	34400.00
UNDERGRND	0.000	0.020	0.020	0.00	13958.00	13958.00
BUILDING	0.487	0.120	0.154	4480.20	43877.80	48358.00

REPORT- LS-C BUILDING PEAK LOAD COMPONENTS

*** BUILDING ***

FLOOR AREA	13958	SQFT	1297	SQMT
VOLUME	418734	CUFT	11859	CUMT

	COOLING LOAD				HEATING LOAD	
TIME	AUG 24	7PM			JAN 4	3AM
DRY-BULB TEMP	92F	33C			8F	-13C
WET-BULB TEMP	76F	24C			7F	-14C
	SENSIBLE		LATENT		SENSIBLE	
	(KBTU/H)	(KW)	(KBTU/H)	(KW)	(KBTU/H)	(KW)
WALLS	69.083	20.233	0.000	0.000	-230.041	-67.373
ROOFS	19.337	5.663	0.000	0.000	-39.155	-11.467
GLASS CONDUCTION	40.916	11.983	0.000	0.000	-151.937	-44.499
GLASS SOLAR	99.635	29.181	0.000	0.000	6.654	1.949
DOOR	0.000	0.000	0.000	0.000	0.000	0.000
INTERNAL SURFACES	0.000	0.000	0.000	0.000	0.000	0.000
UNDERGROUND SURFACES	-1.321	-0.387	0.000	0.000	-6.405	-1.876
OCCUPANTS TO SPACE	27.009	7.910	46.875	13.729	46.820	13.712
LIGHT TO SPACE	104.108	30.491	0.000	0.000	24.551	7.190
EQUIPMENT TO SPACE	96.808	28.353	0.000	0.000	14.187	4.155
PROCESS TO SPACE	0.000	0.000	0.000	0.000	0.000	0.000
INFILTRATION	196.190	57.459	331.012	96.945	-685.158	-200.666
TOTAL	651.766	190.886	377.887	110.674	-1020.485	-298.875
TOTAL LOAD	1029.653 KBTU/H		301.560 KW		-1020.485 KBTU/H	-298.875 KW
TOTAL LOAD / AREA	73.77BTU/H.SQFT		232.555 W /SQMT		73.112BTU/H.SQFT	230.485 W /SQMT

NOTE 1) THE ABOVE LOADS EXCLUDE OUTSIDE VENTILATION AIR LOADS
2) TIMES GIVEN IN STANDARD TIME FOR THE LOCATION IN CONSIDERATION

EMC ENGINEERS INC. EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/27/1995 16:44:58 SDL RUN 1
DENVER, CO 80227 EXISTING CONDITION OF BLDG. 7612 ENL BARRACKS W/AS
REPORT- SS-A SYSTEM MONTHLY LOADS SUMMARY FOR DUAL-T-NTH TOPEKA, KS

	C O O L I N G						H E A T I N G						E L E C	
MONTH	COOLING ENERGY (MBTU)	TIME OF MAX DY	HR	DRY-BULB TEMP	WET-BULB TEMP	MAXIMUM COOLING LOAD (KBTU/HR)	HEATING ENERGY (MBTU)	TIME OF MAX DY	HR	DRY-BULB TEMP	WET-BULB TEMP	MAXIMUM HEATING LOAD (KBTU/HR)	ELEC-TRICAL ENERGY (KWH)	MAXIMUM ELEC LOAD (KW)
JAN	0.00000					0.000	-127.578	4	3	8.F	7.F	-419.091	11007.	26.108
FEB	0.00000					0.000	-92.447	1	23	17.F	15.F	-347.282	9942.	26.108
MAR	0.00000					0.000	-69.998	3	4	16.F	13.F	-325.802	11007.	26.108
APR	0.00000					0.000	-18.511	4	10	34.F	31.F	-203.407	10652.	26.108
MAY	40.54721	30	18	86.F	75.F	195.622	-2.729	5	4	45.F	41.F	-99.964	11007.	26.108
JUN	88.30765	19	12	85.F	75.F	188.916	0.000					0.000	10652.	26.108
JUL	101.69906	13	12	88.F	78.F	184.245	0.000					0.000	11007.	26.108
AUG	100.69477	24	18	93.F	76.F	200.174	0.000					0.000	11007.	26.108
SEP	63.66305	5	17	90.F	77.F	200.296	0.000					0.000	10652.	26.108
OCT	1.22654	1	18	83.F	68.F	132.837	-15.332	19	7	41.F	39.F	-185.669	11007.	26.108
NOV	0.00000					0.000	-51.368	30	5	29.F	26.F	-231.386	10652.	26.108
DEC	0.00000					0.000	-115.159	8	10	24.F	22.F	-354.947	11007.	26.108
TOTAL	396.139						-493.122						129605.	
MAX						200.296						-419.091		26.108

EMC ENGINEERS INC. EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/27/1995 16:44:58 SDL RUN 1
DENVER, CO 80227 EXISTING CONDITION OF BLDG. 7612 ENL BARRACKS W/AS
REPORT- SS-C SYSTEM MONTHLY LOAD HOURS FOR DUAL-T-NTH TOPEKA, KS

	N U M B E R O F H O U R S										--COINCIDENT LOADS--	
MONTH	HOURS COOLING LOAD	HOURS HEATING LOAD	HOURS COINCIDENT COOL-HEAT LOAD	HOURS FLOATING	HOURS HEATING AVAIL.	HOURS COOLING AVAIL.	HOURS FANS ON	HOURS FANS CYCLE ON	HOURS NIGHT VENTING	HOURS FLOATING WHEN FANS ON	HEATING LOAD AT COOLING PEAK (KBTU/HR)	ELECTRIC LOAD AT COOLING PEAK (KW)
JAN	0	743	0	1	744	0	744	0	0	1	-155.714	2.506
FEB	0	672	0	0	672	0	672	0	0	0	-140.158	2.506
MAR	0	703	0	41	744	0	744	0	0	41	-149.153	2.506
APR	0	460	0	260	720	0	720	0	0	260	-14.835	2.506
MAY	381	176	0	187	360	384	744	0	0	187	0.000	26.108
JUN	718	0	0	2	0	720	720	0	0	2	0.000	20.159
JUL	744	0	0	0	0	744	744	0	0	0	0.000	20.159
AUG	744	0	0	0	0	744	744	0	0	0	0.000	26.108
SEP	667	0	0	53	0	720	720	0	0	53	0.000	20.159
OCT	21	446	0	277	720	24	744	0	0	277	0.000	26.108
NOV	0	639	0	81	720	0	720	0	0	81	-164.833	2.506
DEC	0	744	0	0	744	0	744	0	0	0	-144.155	2.506
ANNUAL	3275	4583	0	902	5424	3336	8760	0	0	902		

EMC ENGINEERS INC. EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/27/1995 16:44:58 SDL RUN 1
DENVER, CO 80227 EXISTING CONDITION OF BLDG. 7612 ENL BARRACKS W/AS
REPORT- SS-A SYSTEM MONTHLY LOADS SUMMARY FOR FRESH-AIR TOPEKA, KS

MONTH	COOLING: COOLING ENERGY (MBTU)	COOLING: TIME OF MAX DY	COOLING: TIME OF MAX HR	COOLING: DRY-BULB TEMP	COOLING: WET-BULB TEMP	COOLING: MAXIMUM COOLING LOAD (KBTU/HR)	HEATING: HEATING ENERGY (MBTU)	HEATING: TIME OF MAX DY	HEATING: TIME OF MAX HR	HEATING: DRY-BULB TEMP	HEATING: WET-BULB TEMP	HEATING: MAXIMUM HEATING LOAD (KBTU/HR)	ELEC: ELECTRICAL ENERGY (KWH)	ELEC: MAXIMUM ELEC LOAD (KW)
JAN	0.00000					0.000	-275.932	15	6	-8.F	-9.F	-601.311	6491.	12.635
FEB	0.00000					0.000	-217.831	3	7	-5.F	-6.F	-573.665	5859.	12.635
MAR	0.00000					0.000	-186.542	4	4	14.F	12.F	-500.475	6486.	12.535
APR	0.00000					0.000	-80.912	5	1	30.F	28.F	-341.169	6277.	12.535
MAY	18.82696	31	18	90.F	76.F	313.474	-25.446	1	6	37.F	37.F	-268.456	8304.	42.546
JUN	75.58569	28	18	89.F	76.F	308.402	0.000					0.000	13431.	42.019
JUL	114.85028	17	18	88.F	80.F	365.230	0.000					0.000	17194.	45.385
AUG	118.19416	20	13	92.F	78.F	339.521	0.000					0.000	17939.	44.783
SEP	42.68930	5	18	90.F	77.F	319.461	0.000					0.000	10379.	42.836
OCT	0.59765	1	18	83.F	68.F	130.225	-76.166	20	8	23.F	22.F	-398.804	6546.	25.289
NOV	0.00000					0.000	-157.041	3	4	13.F	12.F	-501.894	6277.	12.535
DEC	0.00000					0.000	-253.968	13	6	2.F	1.F	-532.632	6486.	12.635
TOTAL	370.744						-1273.837						111669.	
MAX						365.230						-601.311		45.385

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EMC ENGINEERS INC. EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/27/1995 16:44:58 SDL RUN 1
DENVER, CO 80227 EXISTING CONDITION OF BLDG. 7612 ENL BARRACKS W/AS
REPORT- SS-C SYSTEM MONTHLY LOAD HOURS FOR FRESH-AIR TOPEKA, KS

MONTH	NUMBER OF HOURS: HOURS COOLING LOAD	HOURS HEATING LOAD	HOURS COINCIDENT COOL-HEAT LOAD	HOURS FLOATING	HOURS HEATING AVAIL.	HOURS COOLING AVAIL.	HOURS FANS ON	HOURS FANS CYCLE ON	HOURS NIGHT VENTING	HOURS FLOATING WHEN FANS ON	COINCIDENT LOADS: HEATING LOAD AT COOLING PEAK (KBTU/HR)	COINCIDENT LOADS: ELECTRIC LOAD AT COOLING PEAK (KW)
JAN	0	744	0	0	744	0	744	0	0	0	-325.292	4.970
FEB	0	672	0	0	672	0	672	0	0	0	-332.784	4.970
MAR	0	744	0	0	744	0	744	0	0	0	-323.657	4.970
APR	0	646	0	74	720	0	720	0	0	74	-175.473	4.970
MAY	187	277	0	280	360	189	744	0	0	280	0.000	42.546
JUN	523	0	0	197	0	524	720	0	0	197	0.000	42.019
JUL	685	0	0	59	0	685	744	0	0	59	0.000	44.587
AUG	671	0	0	73	0	671	744	0	0	73	0.000	40.155
SEP	355	0	0	365	0	356	720	0	0	365	0.000	42.836
OCT	7	614	0	123	720	7	744	0	0	123	0.000	25.289
NOV	0	707	0	13	720	0	720	0	0	13	-382.034	4.970
DEC	0	744	0	0	744	0	744	0	0	0	-360.888	4.970
ANNUAL	2428	5148	0	1184	5424	2432	8760	0	0	1184		

EMC ENGINEERS INC. EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/27/1995 16:44:58 SDL RUN 1
DENVER, CO 80227 EXISTING CONDITION OF BLDG. 7612 ENL BARRACKS W/AS
REPORT- SS-A SYSTEM MONTHLY LOADS SUMMARY FOR DUAL-T-STH TOPEKA, KS

	- - - C O O L I N G - - -						- - - H E A T I N G - - -						- - - E L E C - - -	
MONTH	COOLING ENERGY (MBTU)	TIME OF MAX DY	HR	DRY-BULB TEMP	WET-BULB TEMP	MAXIMUM COOLING LOAD (KBTU/HR)	HEATING ENERGY (MBTU)	TIME OF MAX DY	HR	DRY-BULB TEMP	WET-BULB TEMP	MAXIMUM HEATING LOAD (KBTU/HR)	ELEC-TRICAL ENERGY (KWH)	MAXIMUM ELEC LOAD (KW)
JAN	0.00000					0.000	-92.696	4	3	8.F	7.F	-447.087	12032.	28.539
FEB	0.00000					0.000	-64.016	1	23	17.F	15.F	-361.168	10868.	28.539
MAR	0.00000					0.000	-53.417	3	4	16.F	13.F	-341.968	12032.	28.539
APR	0.00000					0.000	-16.234	4	10	34.F	31.F	-206.973	11644.	28.539
MAY	43.86287	30	18	86.F	75.F	213.081	-2.803	5	4	45.F	41.F	-105.084	12032.	28.539
JUN	94.51183	19	12	85.F	75.F	204.705	0.000					0.000	11644.	28.539
JUL	109.83134	22	18	93.F	78.F	199.783	0.000					0.000	12032.	28.539
AUG	110.24451	24	18	93.F	76.F	218.844	0.000					0.000	12032.	28.539
SEP	74.63847	5	17	90.F	77.F	219.894	0.000					0.000	11644.	28.539
OCT	2.04625	1	17	85.F	68.F	185.575	-11.790	31	7	43.F	39.F	-183.098	12032.	28.539
NOV	0.00000					0.000	-28.048	2	4	17.F	15.F	-207.686	11644.	28.539
DEC	0.00000					0.000	-88.307	8	10	24.F	22.F	-375.087	12032.	28.539
TOTAL	435.134						-357.311						141673.	
MAX						219.894						-447.087		28.539

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EMC ENGINEERS INC. EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/27/1995 16:44:58 SDL RUN 1
DENVER, CO 80227 EXISTING CONDITION OF BLDG. 7612 ENL BARRACKS W/AS
REPORT- SS-C SYSTEM MONTHLY LOAD HOURS FOR DUAL-T-STH TOPEKA, KS

	- - - N U M B E R O F H O U R S - - -										--COINCIDENT LOADS--	
MONTH	HOURS COOLING LOAD	HOURS HEATING LOAD	HOURS COINCIDENT COOL-HEAT LOAD	HOURS FLOATING	HOURS HEATING AVAIL.	HOURS COOLING AVAIL.	HOURS FANS ON	HOURS FANS CYCLE ON	HOURS NIGHT VENTING	HOURS FLOATING WHEN FANS ON	HEATING LOAD AT COOLING PEAK (KBTU/HR)	ELECTRIC LOAD AT COOLING PEAK (KW)
JAN	0	651	0	93	744	0	744	0	0	93	-31.133	2.740
FEB	0	598	0	74	672	0	672	0	0	74	-62.445	2.740
MAR	0	602	0	142	744	0	744	0	0	142	-117.518	2.740
APR	0	424	0	296	720	0	720	0	0	296	-16.190	2.740
MAY	381	175	0	188	360	384	744	0	0	188	0.000	28.539
JUN	718	0	0	2	0	720	720	0	0	2	0.000	22.036
JUL	744	0	0	0	0	744	744	0	0	0	0.000	28.539
AUG	744	0	0	0	0	744	744	0	0	0	0.000	28.539
SEP	675	0	0	45	0	720	720	0	0	45	0.000	22.036
OCT	21	409	0	314	720	24	744	0	0	314	0.000	22.036
NOV	0	497	0	223	720	0	720	0	0	223	-120.045	2.740
DEC	0	667	0	77	744	0	744	0	0	77	-146.343	2.740
ANNUAL	3283	4023	0	1454	5424	3336	8760	0	0	1454		

EMC ENGINEERS INC. EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/27/1995 16:44:58 SDL RUN 1
DENVER, CO 80227 EXISTING CONDITION OF BLDG. 7612 ENL BARRACKS W/AS
REPORT- SS-A SYSTEM MONTHLY LOADS SUMMARY FOR DUAL-T-EST TOPEKA, KS

MONTH	COOLING ENERGY (MBTU)	COOLING TIME OF MAX DY	COOLING TIME OF MAX HR	COOLING DRY-BULB TEMP	COOLING WET-BULB TEMP	MAXIMUM COOLING LOAD (KBTU/HR)	HEATING ENERGY (MBTU)	HEATING TIME OF MAX DY	HEATING TIME OF MAX HR	HEATING DRY-BULB TEMP	HEATING WET-BULB TEMP	MAXIMUM HEATING LOAD (KBTU/HR)	ELEC- TRICAL ENERGY (KWH)	MAXIMUM ELEC LOAD (KW)
JAN	0.00000					0.000	-21.876	4	3	8.F	7.F	-71.246	1944.	4.612
FEB	0.00000					0.000	-16.241	1	23	17.F	15.F	-58.627	1756.	4.612
MAR	0.00000					0.000	-13.134	3	4	16.F	13.F	-54.865	1944.	4.612
APR	0.00000					0.000	-3.909	4	10	34.F	31.F	-35.930	1882.	4.612
MAY	5.87551	30	18	86.F	75.F	32.761	-0.605	5	4	45.F	41.F	-17.170	1944.	4.612
JUN	13.44574	19	19	86.F	75.F	31.694	0.000					0.000	1882.	4.612
JUL	16.09243	13	12	88.F	78.F	31.068	0.000					0.000	1944.	4.612
AUG	16.44134	24	18	93.F	76.F	34.032	0.000					0.000	1944.	4.612
SEP	10.02919	5	17	90.F	77.F	34.045	0.000					0.000	1882.	4.612
OCT	0.14817	1	18	83.F	68.F	15.729	-2.670	19	10	38.F	34.F	-30.813	1944.	4.612
NOV	0.00000					0.000	-8.885	30	4	32.F	28.F	-37.601	1882.	4.612
DEC	0.00000					0.000	-19.858	8	10	24.F	22.F	-61.888	1944.	4.612
TOTAL	62.032						-87.179						22892.	
MAX						34.045						-71.246		4.612

D3-52

EMC ENGINEERS INC. EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/27/1995 16:44:58 SDL RUN 1
DENVER, CO 80227 EXISTING CONDITION OF BLDG. 7612 ENL BARRACKS W/AS
REPORT- SS-C SYSTEM MONTHLY LOAD HOURS FOR DUAL-T-EST TOPEKA, KS

MONTH	HOURS COOLING LOAD	HOURS HEATING LOAD	HOURS COINCIDENT COOL-HEAT LOAD	HOURS FLOATING	HOURS HEATING AVAIL.	HOURS COOLING AVAIL.	HOURS FANS ON	HOURS FANS CYCLE ON	HOURS NIGHT VENTING	HOURS FLOATING WHEN FANS ON	HEATING LOAD AT COOLING PEAK (KBTU/HR)	ELECTRIC LOAD AT COOLING PEAK (KW)
JAN	0	743	0	1	744	0	744	0	0	1	-24.627	0.442
FEB	0	672	0	0	672	0	672	0	0	0	-22.368	0.442
MAR	0	732	0	12	744	0	744	0	0	12	-25.287	0.442
APR	0	495	0	225	720	0	720	0	0	225	-1.703	0.442
MAY	381	190	0	173	360	384	744	0	0	173	0.000	4.612
JUN	718	0	0	2	0	720	720	0	0	2	0.000	4.612
JUL	744	0	0	0	0	744	744	0	0	0	0.000	3.562
AUG	744	0	0	0	0	744	744	0	0	0	0.000	4.612
SEP	663	0	0	57	0	720	720	0	0	57	0.000	3.562
OCT	21	449	0	274	720	24	744	0	0	274	0.000	4.612
NOV	0	647	0	73	720	0	720	0	0	73	-27.386	0.442
DEC	0	744	0	0	744	0	744	0	0	0	-24.632	0.442
ANNUAL	3271	4672	0	817	5424	3336	8760	0	0	817		

EMC ENGINEERS INC. EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/27/1995 16:44:58 SDL RUN 1
DENVER, CO 80227 EXISTING CONDITION OF BLDG. 7612 ENL BARRACKS W/AS
REPORT- SS-A SYSTEM MONTHLY LOADS SUMMARY FOR DUAL-T-WST TOPEKA, KS

MONTH	COOLING ENERGY (MBTU)	TIME OF MAX DY	TIME OF MAX HR	DRY-BULB TEMP	WET-BULB TEMP	MAXIMUM COOLING LOAD (KBTU/HR)	HEATING ENERGY (MBTU)	TIME OF MAX DY	TIME OF MAX HR	DRY-BULB TEMP	WET-BULB TEMP	MAXIMUM HEATING LOAD (KBTU/HR)	ELECTRICAL ENERGY (KWH)	MAXIMUM ELEC LOAD (KW)
	- - - C O O L I N G - - -						- - - H E A T I N G - - -						- - - E L E C - - -	
JAN	0.00000					0.000	-21.993	4	3	8.F	7.F	-71.220	1944.	4.612
FEB	0.00000					0.000	-16.236	1	23	17.F	15.F	-58.537	1756.	4.612
MAR	0.00000					0.000	-13.160	3	4	16.F	13.F	-54.603	1944.	4.612
APR	0.00000					0.000	-4.019	4	10	34.F	31.F	-36.359	1882.	4.612
MAY	5.99942	30	18	86.F	75.F	33.052	-0.602	5	4	45.F	41.F	-17.164	1944.	4.612
JUN	13.38736	19	19	86.F	75.F	31.817	0.000					0.000	1882.	4.612
JUL	16.42722	2	19	84.F	77.F	31.019	0.000					0.000	1944.	4.612
AUG	16.46956	24	19	92.F	76.F	34.142	0.000					0.000	1944.	4.612
SEP	9.97905	5	17	90.F	77.F	34.189	0.000					0.000	1882.	4.612
OCT	0.13856	1	18	83.F	68.F	14.685	-2.682	19	10	38.F	34.F	-30.884	1944.	4.612
NOV	0.00000					0.000	-8.876	30	4	32.F	28.F	-37.428	1882.	4.612
DEC	0.00000					0.000	-19.836	8	10	24.F	22.F	-61.898	1944.	4.612
TOTAL	62.401						-87.404						22892.	
MAX						34.189						-71.220		4.612

D3-53

EMC ENGINEERS INC. EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/27/1995 16:44:58 SDL RUN 1
DENVER, CO 80227 EXISTING CONDITION OF BLDG. 7612 ENL BARRACKS W/AS
REPORT- SS-C SYSTEM MONTHLY LOAD HOURS FOR DUAL-T-WST TOPEKA, KS

MONTH	HOURS COOLING LOAD	HOURS HEATING LOAD	HOURS COINCIDENT COOL-HEAT LOAD	HOURS FLOATING	HOURS HEATING AVAIL.	HOURS COOLING AVAIL.	HOURS FANS ON	HOURS FANS CYCLE ON	HOURS NIGHT VENTING	HOURS FLOATING WHEN FANS ON	HEATING LOAD AT COOLING PEAK (KBTU/HR)	ELECTRIC LOAD AT COOLING PEAK (KW)
	- - - N U M B E R O F H O U R S - - -										--COINCIDENT LOADS--	
JAN	0	743	0	1	744	0	744	0	0	1	-24.242	0.442
FEB	0	672	0	0	672	0	672	0	0	0	-22.266	0.442
MAR	0	731	0	13	744	0	744	0	0	13	-23.291	0.442
APR	0	504	0	216	720	0	720	0	0	216	-1.333	0.442
MAY	381	201	0	162	360	384	744	0	0	162	0.000	4.612
JUN	718	0	0	2	0	720	720	0	0	2	0.000	4.612
JUL	744	0	0	0	0	744	744	0	0	0	0.000	4.612
AUG	744	0	0	0	0	744	744	0	0	0	0.000	4.612
SEP	668	0	0	52	0	720	720	0	0	52	0.000	4.612
OCT	21	456	0	267	720	24	744	0	0	267	0.000	3.562
NOV	0	644	0	76	720	0	720	0	0	76	-26.203	0.442
DEC	0	744	0	0	744	0	744	0	0	0	-24.625	0.442
ANNUAL	3276	4695	0	789	5424	3336	8760	0	0	789		

MO	UTILITY-	ELECTRICITY	NATURAL-GAS
	TOTAL(MBTU)	143.212	768.787
JAN	PEAK(KBTU)	301.008	1936.545
	DY/HR	28/ 9	4/ 3
	TOTAL(MBTU)	129.072	601.310
FEB	PEAK(KBTU)	301.008	1672.482
	DY/HR	3/ 8	1/23
	TOTAL(MBTU)	139.326	513.112
MAR	PEAK(KBTU)	300.667	1635.401
	DY/HR	31/20	3/ 4
	TOTAL(MBTU)	124.354	206.353
APR	PEAK(KBTU)	300.667	1108.685
	DY/HR	14/ 9	4/10
	TOTAL(MBTU)	157.428	57.730
MAY	PEAK(KBTU)	511.359	723.223
	DY/HR	31/18	5/ 4
	TOTAL(MBTU)	205.236	0.000
JUN	PEAK(KBTU)	508.818	0.000
	DY/HR	28/18	30/ 1
	TOTAL(MBTU)	232.826	0.000
JUL	PEAK(KBTU)	531.671	0.000
	DY/HR	23/18	31/ 1
	TOTAL(MBTU)	237.293	0.000
AUG	PEAK(KBTU)	532.480	0.000
	DY/HR	21/19	31/ 1
	TOTAL(MBTU)	178.932	0.000
SEP	PEAK(KBTU)	523.004	0.000
	DY/HR	5/18	30/ 1
	TOTAL(MBTU)	128.742	184.673
OCT	PEAK(KBTU)	426.283	1001.149
	DY/HR	1/18	19/10
	TOTAL(MBTU)	132.196	399.989
NOV	PEAK(KBTU)	300.667	1290.148
	DY/HR	30/20	2/ 4
	TOTAL(MBTU)	142.824	718.337
DEC	PEAK(KBTU)	301.008	1723.529
	DY/HR	13/ 8	14/ 8
	ONE YEAR	1951.440	3450.290
	USE/PEAK	532.480	1936.545

ENERGY TYPE IN SITE MBTU - CATEGORY OF USE	ELECTRICITY	NATURAL-GAS
SPACE HEAT	132.94	3450.29
SPACE COOL	427.44	0.00
HVAC AUX	267.62	0.00
DOM HOT WTR	0.00	0.00
AUX SOLAR	0.00	0.00
LIGHTS	612.35	0.00
VERT TRANS	0.00	0.00
MISC EQUIP	511.11	0.00
TOTAL	1951.46	3450.29

TOTAL SITE ENERGY 5401.73 MBTU 1364.1 KBTU/SQFT-YR GROSS-AREA 387.0 KBTU/SQFT-YR NET-AREA
TOTAL SOURCE ENERGY 9310.47 MBTU 2351.1 KBTU/SQFT-YR GROSS-AREA 667.0 KBTU/SQFT-YR NET-AREA
PERCENT OF HOURS ANY SYSTEM ZONE OUTSIDE OF THROTTLING RANGE = 17.0
PERCENT OF HOURS ANY PLANT LOAD NOT SATISFIED = 0.0
NOTE ELECTRICITY AND/OR FUEL USED TO GENERATE ELECTRICITY IS APPORTIONED BASED ON THE YEARLY DEMAND. ALL OTHER ENERGY TYPES ARE APPORTIONED HOURLY.

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EMC       ENGINEERS       INC.        EZDOE - ELITE SOFTWARE DEVELOPMENT INC        DOE-2.1D    2/22/1995      11:34:22   SDL RUN 1
DENVER,          CO       80227       PROPOSED MODIFICATION FOR BLDG #7612    ENL MEN BARRACKS W/O DIN
REPORT- SS-A  SYSTEM MONTHLY LOADS SUMMARY FOR                  PROP-VAV                  TOPEKA, KS
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	COOLING						HEATING						ELEC	
MONTH	COOLING ENERGY (MBTU)	TIME OF MAX DY	HR	DRY-BULB TEMP	WET-BULB TEMP	MAXIMUM COOLING LOAD (KBTU/HR)	HEATING ENERGY (MBTU)	TIME OF MAX DY	HR	DRY-BULB TEMP	WET-BULB TEMP	MAXIMUM HEATING LOAD (KBTU/HR)	ELEC-TRICAL ENERGY (KWH)	MAXIMUM ELEC LOAD (KW)
JAN	0.00000					0.000	-230.714	15	4	-8.F	-9.F	-614.450	29637.	82.714
FEB	0.00000					0.000	-166.827	3	4	0.F	-1.F	-548.597	26767.	82.714
MAR	0.00000					0.000	-120.777	3	4	16.F	13.F	-491.173	30432.	100.015
APR	0.00000					0.000	-29.423	5	4	32.F	29.F	-295.141	35631.	106.051
MAY	117.93249	16	2	62.F	59.F	764.503	-6.820	5	4	45.F	41.F	-138.672	36793.	106.051
JUN	282.72684	19	19	86.F	75.F	785.889	0.000					0.000	33136.	92.331
JUL	349.56494	23	19	94.F	78.F	843.254	0.000					0.000	35417.	95.645
AUG	340.51385	24	18	93.F	76.F	839.267	0.000					0.000	35553.	95.857
SEP	195.13922	6	18	91.F	75.F	769.845	0.000					0.000	31050.	92.173
OCT	3.98969	1	18	83.F	68.F	381.975	-19.250	20	3	25.F	25.F	-280.845	36428.	106.051
NOV	0.00000					0.000	-88.437	2	4	17.F	15.F	-443.046	31018.	106.048
DEC	0.00000					0.000	-211.862	13	4	5.F	4.F	-545.656	29748.	82.714
TOTAL	1289.868						-874.111						391612.	
MAX						843.254						-614.450		106.051

D3-56

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EMC       ENGINEERS       INC.        EZDOE - ELITE SOFTWARE DEVELOPMENT INC        DOE-2.1D    2/22/1995      11:34:22   SDL RUN 1
DENVER,          CO       80227       PROPOSED MODIFICATION FOR BLDG #7612    ENL MEN BARRACKS W/O DIN
REPORT- SS-C  SYSTEM MONTHLY LOAD HOURS FOR                     PROP-VAV                  TOPEKA, KS
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	NUMBER OF HOURS										COINCIDENT LOADS	
MONTH	HOURS COOLING LOAD	HOURS HEATING LOAD	HOURS COINCIDENT COOL-HEAT LOAD	HOURS FLOATING	HOURS HEATING AVAIL.	HOURS COOLING AVAIL.	HOURS FANS ON	HOURS FANS CYCLE ON	HOURS NIGHT VENTING	HOURS FLOATING WHEN FANS ON	HEATING LOAD AT COOLING PEAK (KBTU/HR)	ELECTRIC LOAD AT COOLING PEAK (KW)
JAN	0	744	0	0	744	0	744	0	0	0	-227.763	5.454
FEB	0	672	0	0	672	0	672	0	0	0	-236.672	5.454
MAR	0	714	0	30	744	0	744	0	0	30	-264.058	5.454
APR	0	430	0	290	720	0	720	0	0	290	0.000	19.557
MAY	384	157	0	203	360	384	744	0	0	203	0.000	22.296
JUN	720	0	0	0	0	720	720	0	0	0	0.000	92.331
JUL	744	0	0	0	0	744	744	0	0	0	0.000	95.645
AUG	744	0	0	0	0	744	744	0	0	0	0.000	95.256
SEP	720	0	0	0	0	720	720	0	0	0	0.000	91.997
OCT	24	271	0	449	720	24	744	0	0	449	0.000	76.363
NOV	0	577	0	143	720	0	720	0	0	143	-331.374	5.454
DEC	0	744	0	0	744	0	744	0	0	0	-385.224	5.454
ANNUAL	3336	4309	0	1115	5424	3336	8760	0	0	1115		

MO	UTILITY-	ELECTRICITY	NATURAL-GAS
	TOTAL(MBTU)	112.439	321.563
JAN	PEAK(KBTU)	288.836	773.180
	DY/HR	9/18	15/ 4
	TOTAL(MBTU)	101.360	242.562
FEB	PEAK(KBTU)	285.337	703.499
	DY/HR	13/18	3/ 4
	TOTAL(MBTU)	112.548	181.573
MAR	PEAK(KBTU)	341.495	641.603
	DY/HR	10/20	3/ 4
	TOTAL(MBTU)	125.087	49.447
APR	PEAK(KBTU)	362.103	422.334
	DY/HR	29/ 9	5/ 4
	TOTAL(MBTU)	169.800	12.195
MAY	PEAK(KBTU)	566.920	233.300
	DY/HR	31/18	5/ 4
	TOTAL(MBTU)	213.259	0.000
JUN	PEAK(KBTU)	571.228	0.000
	DY/HR	19/19	30/ 1
	TOTAL(MBTU)	242.665	0.000
JUL	PEAK(KBTU)	611.549	0.000
	DY/HR	23/19	31/ 1
	TOTAL(MBTU)	244.496	0.000
AUG	PEAK(KBTU)	613.189	0.000
	DY/HR	21/19	31/ 1
	TOTAL(MBTU)	180.954	0.000
SEP	PEAK(KBTU)	580.467	0.000
	DY/HR	6/18	30/ 1
	TOTAL(MBTU)	128.311	32.174
OCT	PEAK(KBTU)	391.692	405.862
	DY/HR	1/18	20/ 3
	TOTAL(MBTU)	112.830	135.902
NOV	PEAK(KBTU)	362.092	588.913
	DY/HR	24/18	2/ 4
	TOTAL(MBTU)	112.604	299.249
DEC	PEAK(KBTU)	288.226	700.355
	DY/HR	21/18	13/ 4
	ONE YEAR	1856.354	1274.666
	USE/PEAK	613.189	773.180

ENERGY TYPE IN SITE MBTU - CATEGORY OF USE	ELECTRICITY	NATURAL-GAS
SPACE HEAT	44.63	1274.67
SPACE COOL	433.49	0.00
HVAC AUX	254.78	0.00
DOM HOT WTR	0.00	0.00
AUX SOLAR	0.00	0.00
LIGHTS	612.35	0.00
VERT TRANS	0.00	0.00
MISC EQUIP	511.10	0.00
TOTAL	1856.36	1274.67

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TOTAL SITE ENERGY       3131.02 MBTU      74.8 KBTU/SQFT-YR GROSS-AREA     224.3 KBTU/SQFT-YR NET-AREA
TOTAL SOURCE ENERGY     6849.30 MBTU     163.6 KBTU/SQFT-YR GROSS-AREA     490.7 KBTU/SQFT-YR NET-AREA
PERCENT OF HOURS ANY SYSTEM ZONE OUTSIDE OF THROTTLING RANGE = 25.1
PERCENT OF HOURS ANY PLANT LOAD NOT SATISFIED                =  0.1
NOTE  ELECTRICITY AND/OR FUEL USED TO GENERATE ELECTRICITY IS APPORTIONED BASED
      ON THE YEARLY DEMAND.  ALL OTHER ENERGY TYPES ARE APPORTIONED HOURLY.
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BUILDING 7806
ANNUAL ENERGY SAVINGS SUMMARY

Item	Baseline	ECO	Annual Energy Savings	Adj. Annual Energy Savings*
Annual Electric (MBTU)	679.99	416.91	263.08	263.08
Annual Natural Gas (MBTU)	185.29	280.54	-95.25	-95.25
Electric Demand June (KW)	58.54	44.88	13.66	13.66
Electric Demand July (KW)	60.91	47.47	13.44	13.44
Electric Demand August (KW)	63.88	50.09	13.79	13.79

*Energy savings prorated on a square foot basis:

Baseline Model Bldg 7656 (sq.ft.)	11310
ECO Model Bldg 7806 (sq.ft.)	11310
Square Footage Adjustment Factor	1.000

LIFE CYCLE COST ANALYSIS SUMMARY
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

LOCATION:	Fort Riley	REGION: 2 (Kansas)		PROJECT NO:	1406-005
PROJECT TITLE:	Feasibility Study for HVAC Upgrade			FISCAL YEAR:	1995
ANALYSIS DATE:	05/04/95	ECONOMIC LIFE:	20	PREPARED BY:	C. Wohlert

1. INVESTMENT: **BLDG 7806 - Replace SZs AHUs w/ VAV AHUs**

A.	CONSTRUCTION COST	=	$31,366	
B.	SIOH COST	(5.5% of 1A) =	$1,725	
C.	DESIGN COST	(6.0% of 1A) =	$1,882	
D.	TOTAL COST	(1A +1B +1C) =	$34,973	
E.	SALVAGE VALUE OF EXISTING EQUIPMENT =		$0	
F.	PUBLIC UTILITY COMPANY REBATE =		$0	
G.	TOTAL INVESTMENT	(1D -1E -1F) =	------->	$34,973

2. ENERGY SAVINGS (+) OR COST (-):

DATE OF NISTR 85-3273-9 USED FOR DISCOUNT FACTORS: JAN '95

	ENERGY SOURCE	FUEL COST $/MBTU (1)	SAVINGS MBTU/YR (2)	ANNUAL $ SAVINGS (3)	DISCOUNT FACTOR (4)	DISCOUNTED SAVINGS (5)	
A.	ELECT.	$12.10	263	$3,183	15.88	$50,550	
B.	DIST	$0.00	0	$0	19.16	$0	
C.	NAT GAS	$4.12	(95)	($392)	18.30	($7,181)	
D.	COAL	$0.00	0	$0	16.62	$0	
E.	ELEC. DEMAND			$735	14.88	$10,937	
F.	TOTAL		168	$3,526		-------->	$54,306

3. NON-ENERGY SAVINGS (+) OR COST (-)

A. ANNUAL RECURRING (+/-)

1	ANNUAL MAINTENANCE	$0	14.88	$0
2		$0	14.88	$0
3		$0	14.88	$0
4	TOTAL ANNUAL DISC. SAVINGS (+) / COST	$0		$0

B. NON-RECURRING (+/-)

ITEM	SAVINGS (+) COST(-) (1)	YEAR OF OCCURRENCE (2)	DISCOUNT FACTOR (3) (TABLE A-2)	DISCOUNTED SAVINGS/COST (4)
a. BASELINE EQUIP. REPLCMNT.	$23,323	5	0.863	$20,128
b.				$0
c.				$0
d.				$0
e.				$0
f. TOTAL	$23,323			$20,128

C. TOTAL NON-ENERGY DISCOUNTED SAVINGS (+) OR COST (-) (3A4 + 3Bf4) = $20,128

4.	FIRST YEAR DOLLAR SAVINGS (+) / COSTS (-)	(2F3+3A4+(3Bf1/Economic Life))	$4,692
5.	SIMPLE PAYBACK (SPB) IN YEARS (MUST BE < 10 YEARS TO QUALIFY)	(1G/4) =	7.45
6.	TOTAL NET DISCOUNTED SAVINGS	(2F5 + 3C) =	$74,433
7.	DISCOUNTED SAVINGS-TO-INVESTMENT RATIO (SIR) (MUST HAVE SIR > 1.25 TO QUALIFY)	(6/1G) =	2.13

ENGINEER'S OPINION OF PROBABLE COST

PROJECT	Fort Riley Feasibility Study for HVAC Upgrade	**SHEET**	1 **OF** 1
ENGINEER	E M C Engineers, Inc.	**DATE PREPARED**	4-May-95
	Denver, CO	**ESTIMATOR**	C. Wohlert
		CHECKED BY	A. Niemeyer

Line No.	Item Refer Code	Item Description	Unit of Measure	MATERIAL COST Quantity	MATERIAL COST Unit Cost	MATERIAL COST Total	LABOR COST Crew/ Worker	LABOR COST Hours/ Unit	LABOR COST Total	TOTAL
1		**BUILDING 7806**								
2		**PROPOSED SYSTEM MODIFICATIONS**								
3										
4		*NEW SYSTEMS INSTALLATION*								
5	AHU5400	5,400 CFM AHU, COOLING ONLY	EA.	1.0	$3,803.33	$3,803	Q-6	30	$603	$4,406
6	AHU8000	8,000 CFM AHU, COOLING ONLY	EA.	1.0	$4,433.18	$4,433	Q-6	40	$804	$5,237
7	VAVBX35	VAV BOX, 3500 CFM, ELEC	EA.	2.0	$310.08	$620	1-SHEE	1.48	$62	$682
8	VAVBX24	VAV BOX, 2400 CFM, ELEC	EA.	2.0	$287.31	$575	1-SHEE	1.33	$55	$630
9	E-TSTAT1	SINGLE SETPOINT ELEC. TSTAT, 3 WIRE	EA.	4.0	$24.23	$97	1-ELEC	0.8	$67	$164
10	WIRE#12	COPPER WIRING #12	C.L.F.	1.3	$7.41	$9	1-ELEC	0.727	$19	$28
11	STLPIP1.5	STEEL PIPE SCH. 40, 1.5" W/HANGERS	L.F.	60.0	$2.95	$177	Q-1	0.2	$233	$409
12		FITTINGS ADD 5%				$9			$12	$20
13	INSLPIP1.25	1.25" FIBERGLASS PIPE INSULATION, 1.5" THCK	L.F.	60.0	$1.40	$84	Q-14	0.08	$88	$172
14	CNTV1	CONTROL VALVE 1"	EA.	2.0	$190.89	$382	1-PLUM	0.471	$20	$402
15	VSD3	VARIABLE SPEED DRIVE W/ CONTRLER,3HP	EA.	2.0	$2,238.39	$4,477	1-ELEC	10.5	$439	$4,916
16	REHEAT3	REHEAT COIL, 2ROW, 3'x1'	EA.	2.0	$154.07	$308	Q-5	1.32	$51	$359
17	REHEAT2	REHEAT COIL, 2ROW, 24"x12"	EA.	2.0	$138.57	$277	Q-5	1.32	$51	$328
18	STLPIP1	STEEL PIPE SCH. 40, 1" W/HANGERS	L.F.	120.0	$2.10	$252	Q-1	0.151	$351	$604
19		VALVES & FITTINGS ADD 15%				$38			$53	$91
20	INSLPIP1	1" FIBERGLASS PIPE INSULATION, 1" THCK	L.F.	120.0	$0.62	$74	Q-14	0.073	$161	$236
21	DUCT500	GAL. STEEL DUCTWORK, 200 TO 500 LB.	LB.	300.0	$0.47	$140	Q-10	0.098	$571	$711
22										
23										
24										
25		*EXISTING SYSTEMS DEMOLITION*								
26		AHU DEMO	TON	2.8			Q-5	17.778	$948	$948
27										
28										
29										
30										
31		**SUBTOTAL**				$15,755			$4,590	$20,344
32	OH	OVERHEAD			17%	$2,647			$771	$3,418
33	PRO	PROFIT			10%	$1,840			$536	$2,376
34	CONT	CONTINGENCY			20%	$4,048			$1,179	$5,228
35	**TOTAL COST**		-	-	-	$24,290	-	-	$7,076	$31,366

ENGINEER'S OPINION OF PROBABLE COST

PROJECT	Fort Riley Feasibility Study for HVAC Upgrade	**SHEET** 1 OF 1	
ENGINEER	E M C Engineers, Inc.	**DATE PREPARED**	4-May-95
	Denver, CO	**ESTIMATOR**	C. Wohlert
		CHECKED BY	A. Niemeyer

Line No.	Item Refer Code	Item Description	Unit of Measure	MATERIAL COST Quantity	MATERIAL COST Unit Cost	MATERIAL COST Total	LABOR COST Crew/ Worker	LABOR COST Hours/ Unit	LABOR COST Total	TOTAL
1		**BUILDING 7806**								
2		**NON-RECURRING**								
3										
4		*EXISTING SYSTEM REPLACEMENT*								
5	AHUH5400	5,400 CFM AHU	EA.	1.0	$4,563.99	$4,564	Q-6	31.5	$633	$5,197
6	AHUH8000	8,000 CFM AHU	EA.	1.0	$5,319.81	$5,320	Q-6	42	$844	$6,164
7	DUCT500	GAL. STEEL DUCTWORK, 200 TO 500 LB.	LB.	300.0	$0.47	$140	Q-10	0.098	$571	$711
8	E-TSTAT1	SINGLE SETPOINT ELEC. TSTAT, 3 WIRE	EA.	2.0	$24.23	$48	1-ELEC	0.8	$33	$82
9	WIRE#12	COPPER WIRING #12	C.L.F.	0.8	$7.41	$6	1-ELEC	0.727	$11	$17
10	STLPIP1.5	STEEL PIPE SCH. 40, 1.5" W/HANGERS	L.F.	120.0	$2.95	$353	Q-1	0.2	$465	$819
11		FITTINGS ADD 5%				$18			$23	$41
12	INSLPIP1.25	1.25" FIBERGLASS PIPE INSULATION, 1.5" THCK	L.F.	120.0	$1.40	$167	Q-14	0.08	$177	$344
13	CNTV1	CONTROL VALVE 1"	EA.	4.0	$190.89	$764	1-PLUM	0.471	$41	$804
14										
15										
16										
17										
18										
19										
20										
21										
22		*EXISTING SYSTEMS DEMOLITION*								
23		AHU DEMO	TON	2.8			Q-5	17.778	$948	$948
24										
25										
26										
27										
28										
29										
30										
31		**SUBTOTAL**				$11,380			$3,748	$15,127
32	OH	OVERHEAD			17%	$1,912			$630	$2,541
33	PRO	PROFIT			10%	$1,329			$438	$1,767
34	CONT	CONTINGENCY			20%	$2,924			$963	$3,887
35	**TOTAL COST**		-	-	-	$17,544	-	-	$5,778	$23,323

ENGINEER'S OPINION OF PROBABLE COST

PROJECT	Fort Riley Feasibility Study for HVAC Upgrade	SHEET 1 OF 1	
		DATE PREPARED	4-May-95
ENGINEER	E M C Engineers, Inc. Denver, CO	ESTIMATOR	C. Wohlert
		CHECKED BY	A. Niemeyer

Line No.	Item Refer Code	Item Description	Unit of Measure	MATERIAL COST Quantity	MATERIAL COST Unit Cost	MATERIAL COST Total	LABOR COST Crew/ Worker	LABOR COST Hours/ Unit	LABOR COST Total	TOTAL
1		BUILDING 7806								
2		*ANNUAL RECURRING*								
3		*ANNUAL MAINTENANCE COST - BASELINE*								
4										
5										
6										
7										
8										
9										
10										
11										
12										
13										
14										
15	TOTAL ANNUAL MAINTENANCE COST - BASELINE		-	-	-	$0	-	-	$0	$0
16										
17		*ANNUAL MAINTENANCE COST - NEW HVAC REPLACEMENT*								
18										
19										
20										
21										
22										
23										
24										
25										
26										
27										
28										
29	TOTAL ANNUAL MAINTENANCE COST - BASELINE		-	-	-	$0	-	-	$0	$0
30										
31										
32										
33										
34										
35	TOTAL ANNUAL MAINTENANCE COST SAVINGS		-	-	-	$0	-	-	$0	$0

DEMAND LIMITING ANALYSIS BUILDING 7806

SUMMER PEAK (KW) = 27812	1993 JUL BILL 7/1-8/2 ACTUAL	1993 AUG BILL 8/2-9/1 ACTUAL	1993 SEP BILL 9/3-10/1 ACTUAL	1993 OCT BILL 10/1-11/1 ACTUAL	1993 NOV BILL 11/1-12/1 ACTUAL	1993 DEC BILL 12/1-1/3 ACTUAL	1993 JAN BILL 1/4-2/1 ACTUAL	1993 FEB BILL 2/1-3/1 ACTUAL	1993 MAR BILL 3/3-4/1 ACTUAL	1993 APR BILL 4/1-5/3 ACTUAL	1993 MAY BILL 5/3-6/1 ACTUAL	1993 JUN BILL 6/1-7/1 ACTUAL
BASE CASE												
CAPACITY (KW)	32472	34452	26136	20754	26400	22752	27108	25812	23310	21834	21996	30096
POWER FACTOR (%)	99.20%	99.10%	99.10%	99.90%	99.80%	99.70%	99.50%	99.60%	99.60%	99.80%	99.60%	98.80%
CAPACITY (KVA)	32734	34765	26373	20775	26453	22820	27244	25916	23404	21878	22084	30462
80% SUMMER PEAK (KVA)	27812	27812	27812	27812	27812	27812	27812	27812	27812	27812	27812	27812
CONTRACT MINIMUM (KVA)	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643
BILLING CAPACITY (KVA)	32734	34765	27812	27812	27812	27812	27812	27812	27812	27812	27812	30462
ACTUAL OR 80% PEAK	ACTUAL	ACTUAL	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	ACTUAL
200 KVA @ $4.45	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00
NEXT 400 @ $4.25	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00
REMAINING @ $4.05	$130,142.18	$138,367.78	$110,208.22	$110,208.22	$110,208.22	$110,208.22	$110,208.22	$110,208.22	$110,208.22	$110,208.22	$110,208.22	$120,939.23
SUB DISCOUNT $.20	($6,546.77)	($6,952.98)	($5,562.38)	($5,562.38)	($5,562.38)	($5,562.38)	($5,562.38)	($5,562.38)	($5,562.38)	($5,562.38)	($5,562.38)	($6,092.31)
CAPACITY CHARGE	$126,185.40	$134,004.80	$107,235.84	$107,235.84	$107,235.84	$107,235.84	$107,235.84	$107,235.84	$107,235.84	$107,235.84	$107,235.84	$117,436.92
TOTAL ENERGY (KWH)	16,920,000	16,200,000	10,980,000	10,140,000	11,160,000	12,930,000	12,600,000	12,270,000	12,480,000	11,070,000	9,720,000	13,170,000
50*KVA @ $.03924	$64,223.85	$68,208.70	$54,566.96	$54,566.96	$54,566.96	$54,566.96	$54,566.96	$54,566.96	$54,566.96	$54,566.96	$54,566.96	$59,765.54
100*KVA @ $.03404	$111,426.10	$118,339.66	$94,671.73	$94,671.73	$94,671.73	$94,671.73	$94,671.73	$94,671.73	$94,671.73	$94,671.73	$94,671.73	$103,691.08
250*KVA @ $.03084	$252,378.15	$268,037.26	$209,965.32	$184,059.72	$214,429.80	$214,429.80	$214,429.80	$214,429.80	$214,429.80	$212,740.92	$171,106.92	$234,858.46
EXCESS @ $.02864	$109,589.57	$65,701.49	$0.00	$0.00	$1,009.19	$51,701.99	$42,250.79	$32,799.59	$38,813.99	$0.00	$0.00	$28,221.42
ENERGY CHARGE	$537,617.67	$520,287.11	$359,204.01	$333,298.41	$364,677.69	$415,370.49	$405,919.29	$396,468.09	$402,482.49	$361,979.61	$320,345.61	$426,536.49
TOTAL CHARGE LESS ECA	$663,803.07	$654,291.92	$466,439.85	$440,534.25	$471,913.53	$522,606.33	$513,155.13	$503,703.93	$509,718.33	$469,215.45	$427,581.45	$543,973.42
DEMAND REDUCTION (KW)	**13.44**	**13.79**	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**13.66**
CAPACITY (KW)	32459	34438	26136	20754	26400	22752	27108	25812	23310	21834	21996	30082
POWER FACTOR (%)	99.20%	99.10%	99.10%	99.90%	99.80%	99.70%	99.50%	99.60%	99.60%	99.80%	99.60%	98.80%
CAPACITY (KVA)	32720	34751	26373	20775	26453	22820	27244	25916	23404	21878	22084	30448
80% SUMMER PEAK (KVA)	27801	27801	27801	27801	27801	27801	27801	27801	27801	27801	27801	27801
CONTRACT MINIMUM (KVA)	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643
BILLING CAPACITY (KVA)	32720	34751	27801	27801	27801	27801	27801	27801	27801	27801	27801	30448
ACTUAL OR 80% PEAK	ACTUAL	ACTUAL	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	ACTUAL
200 KVA @ $4.45	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00
NEXT 400 @ $4.25	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00
REMAINING @ $4.05	$130,087.29	$138,311.44	$110,163.15	$110,163.15	$110,163.15	$110,163.15	$110,163.15	$110,163.15	$110,163.15	$110,163.15	$110,163.15	$120,883.25
SUB DISCOUNT $.20	($6,544.06)	($6,950.19)	($5,560.16)	($5,560.16)	($5,560.16)	($5,560.16)	($5,560.16)	($5,560.16)	($5,560.16)	($5,560.16)	($5,560.16)	($6,089.54)
CAPACITY CHARGE	$126,133.22	$133,951.24	$107,192.99	$107,192.99	$107,192.99	$107,192.99	$107,192.99	$107,192.99	$107,192.99	$107,192.99	$107,192.99	$117,383.70
TOTAL ENERGY (KWH)	16,920,000	16,200,000	10,980,000	10,140,000	11,160,000	12,930,000	12,600,000	12,270,000	12,480,000	11,070,000	9,720,000	13,170,000
50*KVA @ $.03924	$64,197.26	$68,181.41	$54,545.13	$54,545.13	$54,545.13	$54,545.13	$54,545.13	$54,545.13	$54,545.13	$54,545.13	$54,545.13	$59,738.42
100*KVA @ $.03404	$111,379.96	$118,292.31	$94,633.85	$94,633.85	$94,633.85	$94,633.85	$94,633.85	$94,633.85	$94,633.85	$94,633.85	$94,633.85	$103,644.02
250*KVA @ $.03084	$252,273.65	$267,929.99	$210,016.80	$184,111.20	$214,343.99	$214,343.99	$214,343.99	$214,343.99	$214,343.99	$212,792.40	$171,158.40	$234,751.89
EXCESS @ $.02864	$109,744.84	$65,860.87	$0.00	$0.00	$1,136.69	$51,829.49	$42,378.29	$32,927.09	$38,941.49	$0.00	$0.00	$28,379.77
ENERGY CHARGE	$537,595.72	$520,264.57	$359,195.78	$333,290.18	$364,659.66	$415,352.46	$405,901.26	$396,450.06	$402,464.46	$361,971.38	$320,337.38	$426,514.10
TOTAL CHARGE LESS ECA	$663,728.94	$654,215.82	$466,388.77	$440,483.17	$471,852.65	$522,545.45	$513,094.25	$503,643.05	$509,657.45	$469,164.37	$427,530.37	$543,897.80
SUMMARY												
MONTHLY DIFFERENCE	$74.13	$76.10	$51.09	$51.09	$60.88	$60.88	$60.88	$60.88	$60.88	$51.09	$51.09	$75.61
ANNUAL DIFFERENCE.............		**$735**										

NUMBER OF EXTERIOR SURFACES 18 RECTANGULAR 18 OTHER 0
(U-VALUE INCLUDES INSIDE AIR FILM PLUS OUTSIDE AIR FILM AT 7.5 MPH WINDSPEED)

SURFACE	SPACE	- - - - G L A S S - - - - U-VALUE (BTU/HR-SQFT-F)	AREA (SQFT)	- - - - W A L L - - - - U-VALUE (BTU/HR-SQFT-F)	AREA (SQFT)	- W A L L + G L A S S - U-VALUE (BTU/HR-SQFT-F)	AREA (SQFT)	AZIMUTH
	E-PER_ZONE	0.000	0.00	0.092	156.00	0.092	156.00	NORTH
	N-PER_ZONE	0.490	16.00	0.092	686.00	0.101	702.00	NORTH
	N-PER_ZONE	0.490	576.00	0.092	432.00	0.320	1008.00	NORTH
	E-PER_ZONE	0.490	192.00	0.092	843.60	0.166	1035.60	EAST
	S-PER_ZONE	0.490	576.00	0.092	432.00	0.320	1008.00	SOUTH
	S-PER_ZONE	0.490	42.40	0.092	659.60	0.116	702.00	SOUTH
	E-PER_ZONE	0.000	0.00	0.092	156.00	0.092	156.00	SOUTH
	W-PER_ZONE	0.490	115.20	0.092	1438.20	0.122	1553.40	WEST
	W-PER_ZONE	0.000	0.00	0.036	1069.50	0.036	1069.50	ROOF
	E-PER_ZONE	0.000	0.00	0.040	1763.00	0.040	1763.00	ROOF
	CORE_ZONEN	0.000	0.00	0.036	338.40	0.036	338.40	ROOF
	CORE_ZONEN	0.000	0.00	0.040	972.90	0.040	972.90	ROOF
	S-PER_ZONE	0.000	0.00	0.040	1147.50	0.040	1147.50	ROOF
	S-PER_ZONE	0.000	0.00	0.036	472.50	0.036	472.50	ROOF
	N-PER_ZONE	0.000	0.00	0.036	472.50	0.036	472.50	ROOF
	N-PER_ZONE	0.000	0.00	0.040	1147.50	0.040	1147.50	ROOF
	CORE_ZONES	0.000	0.00	0.036	338.40	0.036	338.40	ROOF
	CORE_ZONES	0.000	0.00	0.040	972.90	0.040	972.90	ROOF
	S-PER_ZONE	0.000	0.00	0.020	1620.00	0.020	1620.00	UNDERGRND
	W-PER_ZONE	0.000	0.00	0.020	1069.50	0.020	1069.50	UNDERGRND
	E-PER_ZONE	0.000	0.00	0.020	1763.00	0.020	1763.00	UNDERGRND
	CORE_ZONEN	0.000	0.00	0.020	1311.30	0.020	1311.30	UNDERGRND
	N-PER_ZONE	0.000	0.00	0.020	1620.00	0.020	1620.00	UNDERGRND

EMC ENGINEERS INC. EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/28/1995 16:42:42 LDL RUN 1
DENVER, CO 80227 EXISTING CONDITION OF BLDG. 7806 BATTALIAN HQ BLDG
REPORT- LV-D DETAILS OF EXTERIOR SURFACES IN THE PROJECT TOPEKA, KS

SURFACE	SPACE	- - - - G L A S S - - - - U-VALUE (BTU/HR-SQFT-F)	AREA (SQFT)	- - - - W A L L - - - - U-VALUE (BTU/HR-SQFT-F)	AREA (SQFT)	- W A L L + G L A S S - U-VALUE (BTU/HR-SQFT-F)	AREA (SQFT)	AZIMUTH
	CORE_ZONES	0.000	0.00	0.020	1311.30	0.020	1311.30	UNDERGRND

REPORT- LV-D DETAILS OF EXTERIOR SURFACES IN THE PROJECT

	AVERAGE U-VALUE/GLASS (BTU/HR-SQFT-F)	AVERAGE U-VALUE/WALLS (BTU/HR-SQFT-F)	AVERAGE U-VALUE WALLS+GLASS (BTU/HR-SQFT-F)	GLASS AREA (SQFT)	OPAQUE AREA (SQFT)	GLASS+OPAQUE AREA (SQFT)
NORTH	0.490	0.092	0.218	592.00	1274.00	1866.00
EAST	0.490	0.092	0.166	192.00	843.60	1035.60
SOUTH	0.490	0.092	0.224	618.40	1247.60	1866.00
WEST	0.490	0.092	0.122	115.20	1438.20	1553.40
ROOF	0.000	0.039	0.039	0.00	8695.10	8695.10
ALL WALLS	0.490	0.092	0.188	1517.60	4803.40	6321.00
WALLS+ROOFS	0.490	0.058	0.102	1517.60	13498.50	15016.10
UNDERGRND	0.000	0.020	0.020	0.00	8695.10	8695.10
BUILDING	0.490	0.043	0.072	1517.60	22193.60	23711.20

REPORT- LS-C BUILDING PEAK LOAD COMPONENTS

*** BUILDING ***

FLOOR AREA	11308	SQFT	1051	SQMT
VOLUME	155888	CUFT	4415	CUMT

	COOLING LOAD				HEATING LOAD	
TIME	SEP 6 4PM				JAN 4 3AM	
DRY-BULB TEMP	93F	34C			8F	-13C
WET-BULB TEMP	76F	24C			7F	-14C
	SENSIBLE		LATENT		SENSIBLE	
	(KBTU/H)	(KW)	(KBTU/H)	(KW)	(KBTU/H)	(KW)
WALLS	3.442	1.008	0.000	0.000	-21.795	-6.383
ROOFS	7.640	2.237	0.000	0.000	-20.670	-6.054
GLASS CONDUCTION	16.171	4.736	0.000	0.000	-51.796	-15.170
GLASS SOLAR	64.340	18.844	0.000	0.000	2.180	0.639
DOOR	0.703	0.206	0.000	0.000	-1.970	-0.577
INTERNAL SURFACES	0.000	0.000	0.000	0.000	0.000	0.000
UNDERGROUND SURFACES	-0.760	-0.223	0.000	0.000	-4.993	-1.462
OCCUPANTS TO SPACE	13.533	3.963	25.700	7.527	1.497	0.439
LIGHT TO SPACE	41.317	12.101	0.000	0.000	8.720	2.554
EQUIPMENT TO SPACE	8.708	2.550	0.000	0.000	1.215	0.356
PROCESS TO SPACE	0.000	0.000	0.000	0.000	0.000	0.000
INFILTRATION	47.491	13.909	72.640	21.275	-157.561	-46.146
TOTAL	202.585	59.332	98.340	28.801	-245.173	-71.805
TOTAL LOAD	300.925 KBTU/H		88.133	KW	-245.173 KBTU/H	-71.805 KW
TOTAL LOAD / AREA	26.61BTU/H.SQFT		83.894	W /SQMT	21.682BTU/H.SQFT	68.351 W /SQMT

NOTE
----
1) THE ABOVE LOADS EXCLUDE OUTSIDE VENTILATION AIR LOADS
2) TIMES GIVEN IN STANDARD TIME FOR THE LOCATION IN CONSIDERATION

EMC ENGINEERS INC. EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/28/1995 16:42:42 SDL RUN 1
DENVER, CO 80227 EXISTING CONDITION OF BLDG. 7806 BATTALIAN HQ BLDG
REPORT- SS-A SYSTEM MONTHLY LOADS SUMMARY FOR N_SZ_SYSTM TOPEKA, KS

MONTH	COOLING ENERGY (MBTU)	COOLING TIME OF MAX DY	COOLING TIME OF MAX HR	COOLING DRY-BULB TEMP	COOLING WET-BULB TEMP	MAXIMUM COOLING LOAD (KBTU/HR)	HEATING ENERGY (MBTU)	HEATING TIME OF MAX DY	HEATING TIME OF MAX HR	HEATING DRY-BULB TEMP	HEATING WET-BULB TEMP	MAXIMUM HEATING LOAD (KBTU/HR)	ELEC- TRICAL ENERGY (KWH)	MAXIMUM ELEC LOAD (KW)
JAN	0.00000					0.000	-23.548	4	3	8.F	7.F	-87.836	5987.	12.950
FEB	0.00000					0.000	-15.055	1	23	17.F	15.F	-66.839	5411.	12.950
MAR	0.00000					0.000	-8.787	3	4	16.F	13.F	-67.103	6203.	12.950
APR	0.00000					0.000	-1.117	4	6	32.F	31.F	-30.839	5867.	12.950
MAY	19.99711	16	2	62.F	59.F	228.221	-0.257	3	22	58.F	56.F	-7.037	5987.	12.950
JUN	41.56113	21	16	88.F	74.F	128.678	0.000					0.000	5975.	12.950
JUL	46.98882	1	16	86.F	80.F	138.251	0.000					0.000	5879.	12.950
AUG	47.26728	24	19	92.F	76.F	138.383	0.000					0.000	6203.	12.950
SEP	30.63215	6	16	93.F	76.F	135.817	0.000					0.000	5867.	12.950
OCT	0.42061	1	17	85.F	68.F	50.434	-0.869	31	7	43.F	39.F	-31.089	5879.	12.950
NOV	0.00000					0.000	-5.784	28	6	26.F	24.F	-40.961	5759.	12.950
DEC	0.00000					0.000	-20.068	11	24	10.F	9.F	-74.184	5987.	12.950
TOTAL	186.867						-75.484						71002.	
MAX						228.221						-87.836		12.950

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EMC ENGINEERS INC. EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/28/1995 16:42:42 SDL RUN 1
DENVER, CO 80227 EXISTING CONDITION OF BLDG. 7806 BATTALIAN HQ BLDG
REPORT- SS-C SYSTEM MONTHLY LOAD HOURS FOR N_SZ_SYSTM TOPEKA, KS

MONTH	HOURS COOLING LOAD	HOURS HEATING LOAD	HOURS COINCIDENT COOL-HEAT LOAD	HOURS FLOATING	HOURS HEATING AVAIL.	HOURS COOLING AVAIL.	HOURS FANS ON	HOURS FANS CYCLE ON	HOURS NIGHT VENTING	HOURS FLOATING WHEN FANS ON	COINCIDENT LOADS: HEATING LOAD AT COOLING PEAK (KBTU/HR)	COINCIDENT LOADS: ELECTRIC LOAD AT COOLING PEAK (KW)
JAN	0	716	0	28	744	0	744	0	0	28	-22.297	5.072
FEB	0	638	0	34	672	0	672	0	0	34	-19.505	5.072
MAR	0	557	0	187	744	0	744	0	0	187	-15.554	5.072
APR	0	365	0	355	720	0	720	0	0	355	-1.901	4.992
MAY	384	163	0	197	360	384	744	0	0	197	0.000	5.072
JUN	720	0	0	0	0	720	720	0	0	0	0.000	12.950
JUL	744	0	0	0	0	744	744	0	0	0	0.000	12.950
AUG	744	0	0	0	0	744	744	0	0	0	0.000	12.950
SEP	657	0	0	63	0	657	720	0	0	63	0.000	12.950
OCT	14	352	0	378	720	14	744	0	0	378	0.000	4.992
NOV	0	517	0	203	720	0	720	0	0	203	-25.679	5.072
DEC	0	706	0	38	744	0	744	0	0	38	-34.098	4.992
ANNUAL	3263	4014	0	1483	5424	3263	8760	0	0	1483		

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EMC       ENGINEERS     INC.       EZDOE - ELITE SOFTWARE DEVELOPMENT INC        DOE-2.1D   2/28/1995     16:42:42   SDL RUN 1
 DENVER,      CO         80227       EXISTING CONDITION OF BLDG. 7806          BATTALIAN HQ BLDG
REPORT- SS-A  SYSTEM MONTHLY LOADS SUMMARY FOR              S_SZ_SYSTM                TOPEKA, KS
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MONTH	COOLING ENERGY (MBTU)	COOLING TIME OF MAX DY	COOLING TIME OF MAX HR	COOLING DRY-BULB TEMP	COOLING WET-BULB TEMP	MAXIMUM COOLING LOAD (KBTU/HR)	HEATING ENERGY (MBTU)	HEATING TIME OF MAX DY	HEATING TIME OF MAX HR	HEATING DRY-BULB TEMP	HEATING WET-BULB TEMP	MAXIMUM HEATING LOAD (KBTU/HR)	ELECTRICAL ENERGY (KWH)	MAXIMUM ELEC LOAD (KW)
JAN	0.00000					0.000	-13.875	4	3	8.F	7.F	-80.337	6400.	14.145
FEB	0.00000					0.000	-7.130	2	4	10.F	9.F	-57.465	5784.	14.145
MAR	0.00000					0.000	-4.570	3	4	16.F	13.F	-59.035	6644.	14.145
APR	0.00000					0.000	-0.744	5	6	31.F	28.F	-19.872	6276.	14.145
MAY	22.75988	16	2	62.F	59.F	228.613	-0.315	3	22	58.F	56.F	-7.249	6400.	14.145
JUN	45.82773	21	16	88.F	74.F	135.044	0.000					0.000	6398.	14.145
JUL	52.00711	1	16	86.F	80.F	149.645	0.000					0.000	6277.	14.145
AUG	54.94657	24	16	96.F	77.F	165.374	0.000					0.000	6644.	14.145
SEP	40.82925	6	16	93.F	76.F	170.048	0.000					0.000	6276.	14.145
OCT	1.01801	1	16	83.F	67.F	108.812	-0.919	2	5	55.F	53.F	-11.556	6277.	14.145
NOV	0.00000					0.000	-1.618	2	6	15.F	14.F	-37.692	6154.	14.145
DEC	0.00000					0.000	-12.638	11	24	10.F	9.F	-68.590	6400.	14.145
TOTAL	217.389						-41.809						75932.	
MAX						228.613						-80.337		14.145

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EMC       ENGINEERS     INC.       EZDOE - ELITE SOFTWARE DEVELOPMENT INC        DOE-2.1D   2/28/1995     16:42:42   SDL RUN 1
 DENVER,      CO         80227       EXISTING CONDITION OF BLDG. 7806          BATTALIAN HQ BLDG
REPORT- SS-C  SYSTEM MONTHLY LOAD HOURS FOR                 S_SZ_SYSTM                TOPEKA, KS
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MONTH	HOURS COOLING LOAD	HOURS HEATING LOAD	HOURS COINCIDENT COOL-HEAT LOAD	HOURS FLOATING	HOURS HEATING AVAIL.	HOURS COOLING AVAIL.	HOURS FANS ON	HOURS FANS CYCLE ON	HOURS NIGHT VENTING	HOURS FLOATING WHEN FANS ON	COINCIDENT LOADS: HEATING LOAD AT COOLING PEAK (KBTU/HR)	COINCIDENT LOADS: ELECTRIC LOAD AT COOLING PEAK (KW)
JAN	0	661	0	83	744	0	744	0	0	83	-3.886	5.238
FEB	0	536	0	136	672	0	672	0	0	136	-2.896	5.238
MAR	0	500	0	244	744	0	744	0	0	244	-2.751	5.238
APR	0	384	0	336	720	0	720	0	0	336	-2.345	5.148
MAY	384	172	0	188	360	384	744	0	0	188	0.000	5.238
JUN	720	0	0	0	0	720	720	0	0	0	0.000	14.145
JUL	744	0	0	0	0	744	744	0	0	0	0.000	14.145
AUG	744	0	0	0	0	744	744	0	0	0	0.000	14.145
SEP	686	0	0	34	0	686	720	0	0	34	0.000	14.145
OCT	15	409	0	320	720	15	744	0	0	320	0.000	5.148
NOV	0	480	0	240	720	0	720	0	0	240	-0.895	5.238
DEC	0	630	0	114	744	0	744	0	0	114	-37.222	5.148
ANNUAL	3293	3772	0	1695	5424	3293	8760	0	0	1695		

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EMC        ENGINEERS      INC.        EZDOE - ELITE SOFTWARE DEVELOPMENT INC         DOE-2.1D   2/28/1995    16:42:42  PDL RUN 1
DENVER,        CO         80227       EXISTING CONDITION OF BLDG. 7806         BATTALIAN HQ BLDG
REPORT- PS-B  MONTHLY PEAK AND TOTAL ENERGY USE                                         TOPEKA, KS
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MO	UTILITY-	ELECTRICITY	NATURAL-GAS
	TOTAL(MBTU)	44.608	55.844
JAN	PEAK(KBTU)	96.556	211.968
	DY/HR	28/12	4/ 3
	TOTAL(MBTU)	40.039	35.543
FEB	PEAK(KBTU)	96.556	163.289
	DY/HR	22/ 9	2/ 3
	TOTAL(MBTU)	45.021	21.714
MAR	PEAK(KBTU)	96.556	166.900
	DY/HR	31/ 9	3/ 4
	TOTAL(MBTU)	41.801	3.964
APR	PEAK(KBTU)	95.241	77.213
	DY/HR	5/ 8	5/ 6
	TOTAL(MBTU)	60.036	1.335
MAY	PEAK(KBTU)	199.006	25.635
	DY/HR	16/16	3/22
	TOTAL(MBTU)	78.518	0.000
JUN	PEAK(KBTU)	199.792	0.000
	DY/HR	21/16	30/ 1
	TOTAL(MBTU)	82.136	0.000
JUL	PEAK(KBTU)	207.894	0.000
	DY/HR	22/16	31/ 1
	TOTAL(MBTU)	87.141	0.000
AUG	PEAK(KBTU)	218.010	0.000
	DY/HR	24/16	31/ 1
	TOTAL(MBTU)	72.172	0.000
SEP	PEAK(KBTU)	215.554	0.000
	DY/HR	6/16	30/ 1
	TOTAL(MBTU)	42.501	3.891
OCT	PEAK(KBTU)	96.629	68.444
	DY/HR	1/17	31/ 7
	TOTAL(MBTU)	41.544	13.248
NOV	PEAK(KBTU)	96.556	113.371
	DY/HR	2/ 8	2/ 6
	TOTAL(MBTU)	44.477	49.755
DEC	PEAK(KBTU)	96.556	184.983
	DY/HR	30/20	11/24
	ONE YEAR	679.995	185.295
	USE/PEAK	218.010	211.968

ENERGY TYPE IN SITE MBTU - CATEGORY OF USE	ELECTRICITY	NATURAL-GAS
SPACE HEAT	7.83	185.29
SPACE COOL	152.42	0.00
HVAC AUX	321.36	0.00
DOM HOT WTR	0.00	0.00
AUX SOLAR	0.00	0.00
LIGHTS	165.33	0.00
VERT TRANS	0.00	0.00
MISC EQUIP	33.06	0.00
TOTAL	679.99	185.29

TOTAL SITE ENERGY 865.29 MBTU 76.5 KBTU/SQFT-YR GROSS-AREA 76.5 KBTU/SQFT-YR NET-AREA
TOTAL SOURCE ENERGY 2227.32 MBTU 196.9 KBTU/SQFT-YR GROSS-AREA 197.0 KBTU/SQFT-YR NET-AREA
PERCENT OF HOURS ANY SYSTEM ZONE OUTSIDE OF THROTTLING RANGE = 9.3
PERCENT OF HOURS ANY PLANT LOAD NOT SATISFIED = 0.0
NOTE ELECTRICITY AND/OR FUEL USED TO GENERATE ELECTRICITY IS APPORTIONED BASED ON THE YEARLY DEMAND. ALL OTHER ENERGY TYPES ARE APPORTIONED HOURLY.

EMC ENGINEERS INC. EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/22/1995 14:14:48 SDL RUN 1
DENVER, CO 80227 PROPOSED MODIFICATION OF BLDG. 7806 BATTALIAN HQ BLDG
REPORT- SS-A SYSTEM MONTHLY LOADS SUMMARY FOR N_VAV_SYST TOPEKA, KS

MONTH	COOLING: COOLING ENERGY (MBTU)	COOLING: TIME OF MAX DY	COOLING: TIME OF MAX HR	COOLING: DRY-BULB TEMP	COOLING: WET-BULB TEMP	COOLING: MAXIMUM COOLING LOAD (KBTU/HR)	HEATING: HEATING ENERGY (MBTU)	HEATING: TIME OF MAX DY	HEATING: TIME OF MAX HR	HEATING: DRY-BULB TEMP	HEATING: WET-BULB TEMP	HEATING: MAXIMUM HEATING LOAD (KBTU/HR)	ELEC: ELEC-TRICAL ENERGY (KWH)	ELEC: MAXIMUM ELEC LOAD (KW)
JAN	0.00000					0.000	-28.434	15	8	-6.F	-7.F	-68.764	2543.	10.739
FEB	0.00000					0.000	-20.152	3	6	-1.F	-2.F	-63.647	2347.	13.550
MAR	0.00000					0.000	-13.026	14	6	15.F	13.F	-52.349	3319.	14.927
APR	0.00000					0.000	-3.299	5	6	31.F	28.F	-32.519	4052.	14.927
MAY	13.08116	16	2	62.F	59.F	140.967	-0.860	11	3	52.F	51.F	-11.611	3650.	14.927
JUN	27.83931	29	19	87.F	74.F	90.252	0.000					0.000	2784.	10.019
JUL	32.33242	22	19	92.F	78.F	99.169	0.000					0.000	2620.	10.261
AUG	32.08073	24	18	93.F	76.F	94.500	0.000					0.000	2952.	10.186
SEP	19.81511	8	18	89.F	72.F	81.451	0.000					0.000	2571.	9.711
OCT	0.37803	1	17	85.F	68.F	24.349	-3.357	2	2	64.F	59.F	-58.889	3501.	14.927
NOV	0.00000					0.000	-12.374	3	6	13.F	12.F	-50.130	2906.	14.927
DEC	0.00000					0.000	-24.852	12	6	3.F	2.F	-62.740	2605.	9.841
TOTAL	125.527						-106.354						35850.	
MAX						140.967						-68.764		14.927

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EMC ENGINEERS INC. EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/22/1995 14:14:48 SDL RUN 1
DENVER, CO 80227 PROPOSED MODIFICATION OF BLDG. 7806 BATTALIAN HQ BLDG
REPORT- SS-C SYSTEM MONTHLY LOAD HOURS FOR N_VAV_SYST TOPEKA, KS

MONTH	HOURS COOLING LOAD	HOURS HEATING LOAD	HOURS COINCIDENT COOL-HEAT LOAD	HOURS FLOATING	HOURS HEATING AVAIL.	HOURS COOLING AVAIL.	HOURS FANS ON	HOURS FANS CYCLE ON	HOURS NIGHT VENTING	HOURS FLOATING WHEN FANS ON	COINCIDENT LOADS: HEATING LOAD AT COOLING PEAK (KBTU/HR)	COINCIDENT LOADS: ELECTRIC LOAD AT COOLING PEAK (KW)
JAN	0	743	0	1	744	0	744	0	0	1	-33.635	0.400
FEB	0	667	0	5	672	0	672	0	0	5	-32.198	0.400
MAR	0	646	0	98	744	0	744	0	0	98	-22.976	0.778
APR	0	436	0	284	720	0	720	0	0	284	-7.931	1.211
MAY	384	163	0	197	360	384	744	0	0	197	0.000	3.921
JUN	720	0	0	0	0	720	720	0	0	0	0.000	10.019
JUL	744	0	0	0	0	744	744	0	0	0	0.000	10.261
AUG	744	0	0	0	0	744	744	0	0	0	0.000	10.157
SEP	720	0	0	0	0	720	720	0	0	0	0.000	9.711
OCT	24	385	0	335	720	24	744	0	0	335	0.000	0.321
NOV	0	601	0	119	720	0	720	0	0	119	-36.602	0.457
DEC	0	741	0	3	744	0	744	0	0	3	-46.252	0.321
ANNUAL	3336	4382	0	1042	5424	3336	8760	0	0	1042		

EMC DENVER, ENGINEERS CO INC. 80227 EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/22/1995 14:14:48 SDL RUN 1
PROPOSED MODIFICATION OF BLDG. 7806 BATTALIAN HQ BLDG TOPEKA, KS
REPORT- SS-A SYSTEM MONTHLY LOADS SUMMARY FOR S_VAV_SYST

MONTH	COOLING ENERGY (MBTU)	COOLING TIME OF MAX DY	COOLING TIME OF MAX HR	COOLING DRY-BULB TEMP	COOLING WET-BULB TEMP	MAXIMUM COOLING LOAD (KBTU/HR)	HEATING ENERGY (MBTU)	HEATING TIME OF MAX DY	HEATING TIME OF MAX HR	HEATING DRY-BULB TEMP	HEATING WET-BULB TEMP	MAXIMUM HEATING LOAD (KBTU/HR)	ELEC- TRICAL ENERGY (KWH)	MAXIMUM ELEC LOAD (KW)
JAN	0.00000					0.000	-23.710	15	8	-6.F	-7.F	-82.394	3395.	14.042
FEB	0.00000					0.000	-16.001	3	7	-5.F	-6.F	-68.710	3320.	15.423
MAR	0.00000					0.000	-9.500	14	6	15.F	13.F	-57.256	4641.	16.184
APR	0.00000					0.000	-2.104	5	6	31.F	28.F	-33.735	5290.	16.184
MAY	16.16931	16	2	62.F	59.F	148.838	-1.236	11	3	52.F	51.F	-18.813	4292.	16.184
JUN	35.24581	29	16	89.F	75.F	122.405	0.000					0.000	3288.	12.130
JUL	41.42882	13	16	93.F	77.F	131.518	0.000					0.000	3118.	12.480
AUG	44.38872	23	16	96.F	77.F	146.479	0.000					0.000	3650.	13.531
SEP	29.63825	7	16	93.F	76.F	148.987	0.000					0.000	3191.	13.908
OCT	0.56560	1	17	85.F	68.F	55.012	-1.172	31	6	44.F	39.F	-27.618	5356.	16.184
NOV	0.00000					0.000	-6.516	2	6	15.F	14.F	-54.092	4542.	16.184
DEC	0.00000					0.000	-21.072	12	6	3.F	2.F	-74.566	3660.	14.511
TOTAL	167.437						-81.311						47744.	
MAX						148.987						-82.394		16.184

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EMC DENVER, ENGINEERS CO INC. 80227 EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/22/1995 14:14:48 SDL RUN 1
PROPOSED MODIFICATION OF BLDG. 7806 BATTALIAN HQ BLDG TOPEKA, KS
REPORT- SS-C SYSTEM MONTHLY LOAD HOURS FOR S_VAV_SYST

MONTH	HOURS COOLING LOAD	HOURS HEATING LOAD	HOURS COINCIDENT COOL-HEAT LOAD	HOURS FLOATING	HOURS HEATING AVAIL.	HOURS COOLING AVAIL.	HOURS FANS ON	HOURS FANS CYCLE ON	HOURS NIGHT VENTING	HOURS FLOATING WHEN FANS ON	COINCIDENT LOADS HEATING LOAD AT COOLING PEAK (KBTU/HR)	COINCIDENT LOADS ELECTRIC LOAD AT COOLING PEAK (KW)
JAN	0	713	0	31	744	0	744	0	0	31	-10.892	2.920
FEB	0	628	0	44	672	0	672	0	0	44	-9.101	3.690
MAR	0	449	0	295	744	0	744	0	0	295	-11.307	3.185
APR	0	245	0	475	720	0	720	0	0	475	0.000	7.187
MAY	384	159	0	201	360	384	744	0	0	201	0.000	3.674
JUN	720	0	0	0	0	720	720	0	0	0	0.000	12.130
JUL	744	0	0	0	0	744	744	0	0	0	0.000	12.480
AUG	744	0	0	0	0	744	744	0	0	0	0.000	13.531
SEP	720	0	0	0	0	720	720	0	0	0	0.000	13.908
OCT	24	113	0	607	720	24	744	0	0	607	0.000	0.949
NOV	0	414	0	306	720	0	720	0	0	306	-21.906	1.136
DEC	0	679	0	65	744	0	744	0	0	65	-50.341	0.331
ANNUAL	3336	3400	0	2024	5424	3336	8760	0	0	2024		

MO	UTILITY-	ELECTRICITY	NATURAL-GAS
	TOTAL(MBTU)	22.822	74.066
JAN	PEAK(KBTU)	80.648	190.522
	DY/HR	12/14	15/ 8
	TOTAL(MBTU)	21.493	53.561
FEB	PEAK(KBTU)	88.853	169.770
	DY/HR	25/19	3/ 6
	TOTAL(MBTU)	28.769	34.735
MAR	PEAK(KBTU)	98.014	145.869
	DY/HR	10/19	14/ 6
	TOTAL(MBTU)	32.565	9.851
APR	PEAK(KBTU)	106.225	96.888
	DY/HR	26/13	5/ 6
	TOTAL(MBTU)	39.394	3.937
MAY	PEAK(KBTU)	162.242	51.775
	DY/HR	16/16	11/ 3
	TOTAL(MBTU)	46.266	0.000
JUN	PEAK(KBTU)	153.180	0.000
	DY/HR	29/16	30/ 1
	TOTAL(MBTU)	48.936	0.000
JUL	PEAK(KBTU)	162.008	0.000
	DY/HR	22/16	31/ 1
	TOTAL(MBTU)	53.696	0.000
AUG	PEAK(KBTU)	170.955	0.000
	DY/HR	11/16	31/ 1
	TOTAL(MBTU)	40.961	0.000
SEP	PEAK(KBTU)	163.793	0.000
	DY/HR	7/16	30/ 1
	TOTAL(MBTU)	31.271	8.038
OCT	PEAK(KBTU)	98.014	113.910
	DY/HR	12/ 8	2/ 2
	TOTAL(MBTU)	26.915	29.949
NOV	PEAK(KBTU)	98.014	137.335
	DY/HR	17/20	2/ 6
	TOTAL(MBTU)	23.829	66.398
DEC	PEAK(KBTU)	82.182	175.886
	DY/HR	23/11	12/ 6
	ONE YEAR	416.915	280.536
	USE/PEAK	170.955	190.522

ENERGY TYPE IN SITE MBTU - CATEGORY OF USE	ELECTRICITY	NATURAL-GAS
SPACE HEAT	10.38	280.54
SPACE COOL	109.06	0.00
HVAC AUX	99.07	0.00
DOM HOT WTR	0.00	0.00
AUX SOLAR	0.00	0.00
LIGHTS	165.33	0.00
VERT TRANS	0.00	0.00
MISC EQUIP	33.07	0.00
TOTAL	416.91	280.54

TOTAL SITE ENERGY 697.45 MBTU 61.6 KBTU/SQFT-YR GROSS-AREA 61.7 KBTU/SQFT-YR NET-AREA
TOTAL SOURCE ENERGY 1532.53 MBTU 135.5 KBTU/SQFT-YR GROSS-AREA 135.5 KBTU/SQFT-YR NET-AREA
PERCENT OF HOURS ANY SYSTEM ZONE OUTSIDE OF THROTTLING RANGE = 55.7
PERCENT OF HOURS ANY PLANT LOAD NOT SATISFIED = 0.0
NOTE ELECTRICITY AND/OR FUEL USED TO GENERATE ELECTRICITY IS APPORTIONED BASED ON THE YEARLY DEMAND. ALL OTHER ENERGY TYPES ARE APPORTIONED HOURLY.

BUILDING 8025
ANNUAL ENERGY SAVINGS SUMMARY

Item	Baseline	ECO	Annual Energy Savings	Adj. Annual Energy Savings*
Annual Electric (MBTU)	279.74	210.23	69.51	65.38
Annual Natural Gas (MBTU)			0.00	0.00
Electric Demand June (KW)	49.28	51.48	-2.19	-2.06
Electric Demand July (KW)	50.66	52.89	-2.22	-2.09
Electric Demand August (KW)	51.18	53.42	-2.24	-2.11

*Energy savings prorated on a square foot basis:

Baseline Model Bldg 7108 (sq.ft.)	12180
ECO Model Bldg 8025 (sq.ft.)	11456
Square Footage Adjustment Factor	0.941

LIFE CYCLE COST ANALYSIS SUMMARY
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

LOCATION:	Fort Riley	REGION: 2 (Kansas)		PROJECT NO:	1406-005
PROJECT TITLE:	Feasibility Study for HVAC Upgrade			FISCAL YEAR:	1995
ANALYSIS DATE:	05/04/95	ECONOMIC LIFE:	20	PREPARED BY:	C. Wohlert

1. INVESTMENT: **BLDG 8025 - Convert (3) Existing MZs to VAV AHUs**

A.	CONSTRUCTION COST	=	$15,500	
B.	SIOH COST	(5.5% of 1A) =	$852	
C.	DESIGN COST	(6.0% of 1A) =	$930	
D.	TOTAL COST	(1A +1B +1C) =	$17,282	
E.	SALVAGE VALUE OF EXISTING EQUIPMENT =		$0	
F.	PUBLIC UTILITY COMPANY REBATE =		$0	
G.	TOTAL INVESTMENT	(1D -1E -1F) =	------->	$17,282

2. ENERGY SAVINGS (+) OR COST (-):

DATE OF NISTR 85-3273-9 USED FOR DISCOUNT FACTORS: JAN '95

	ENERGY SOURCE	FUEL COST $/MBTU (1)	SAVINGS MBTU/YR (2)	ANNUAL $ SAVINGS (3)	DISCOUNT FACTOR (4)	DISCOUNTED SAVINGS (5)	
A.	ELECT.	$12.10	65	$791	15.88	$12,563	
B.	DIST	$0.00	0	$0	19.16	$0	
C.	NAT GAS	$4.12	0	$0	18.30	$0	
D.	COAL	$0.00	0	$0	16.62	$0	
E.	ELEC. DEMAND			($112)	14.88	($1,667)	
F.	TOTAL		65	$679		-------->	$10,896

3. NON-ENERGY SAVINGS (+) OR COST (-)

A. ANNUAL RECURRING (+/-)

1 ANNUAL MAINTENANCE	$0	14.88	$0
2	$0	14.88	$0
3	$0	14.88	$0
4 TOTAL ANNUAL DISC. SAVINGS (+) / COST (-	$0		$0

B. NON-RECURRING (+/-)

ITEM	SAVINGS (+) COST(-) (1)	YEAR OF OCCURRENCE (2)	DISCOUNT FACTOR (3) (TABLE A-2)	DISCOUNTED SAVINGS/COST (4)
a. BASELINE EQUIP. REPLCMNT.	$0	5	0.863	$0
b.				$0
c.				$0
d. TOTAL	$0			$0

C. TOTAL NON-ENERGY DISCOUNTED SAVINGS (+) OR COST (-) (3A4 + 3Bd4) = $0

4.	FIRST YEAR DOLLAR SAVINGS (+) / COSTS (-)	(2F3+3A4+(3Bd1/Economic Life))	$679
5.	SIMPLE PAYBACK (SPB) IN YEARS (MUST BE < 10 YEARS TO QUALIFY)	(1G/4) =	25.45
6.	TOTAL NET DISCOUNTED SAVINGS	(2F5 + 3C) =	$10,896
7.	DISCOUNTED SAVINGS-TO-INVESTMENT RATIO (SIR) (MUST HAVE SIR > 1.25 TO QUALIFY)	(6/1G) =	0.63

ENGINEER'S OPINION OF PROBABLE COST

PROJECT	Fort Riley Feasibility Study for HVAC Upgrade	**SHEET** 1	**OF** 1
ENGINEER	E M C Engineers, Inc. Denver, CO	**DATE PREPARED**	4-May-95
		ESTIMATOR	C. Wohlert
		CHECKED BY	A. Niemeyer

Line No.	Item Refer Code	Item Description	Unit of Measure	MATERIAL COST Quantity	MATERIAL COST Unit Cost	MATERIAL COST Total	LABOR COST Crew/ Worker	LABOR COST Hours/ Unit	LABOR COST Total	TOTAL
1		**BUILDING 8025**								
2		**PROPOSED SYSTEM MODIFICATIONS**								
3										
4		*NEW SYSTEMS INSTALLATION*								
5		BLANK OFF HOT DECK	EA.	1.0	$50.00	$50	1-CLAB	3	$43	$93.4
6	VSD3	VARIABLE SPEED DRIVE W/ CONTRLER,3HP	EA.	3.0	$2,238.39	$6,715	1-ELEC	10.5	$659	$7,374
7	VAVCNTL2	VAV BOX CONTROLLER & ACTUATOR, ELEC	EA.	11.0	$155.04	$1,705	1-ELEC	0.33	$76	$1,781
8	E-TSTAT1	SINGLE SETPOINT ELEC. TSTAT, 3 WIRE	EA.	11.0	$24.23	$266	1-ELEC	0.8	$184	$451
9	WIRE#12	COPPER WIRING #12	C.L.F.	5.5	$7.41	$41	1-ELEC	0.727	$84	$124
10										
11										
12										
13										
14										
15										
16										
17										
18										
19										
20										
21										
22										
23		*EXISTING SYSTEMS DEMOLITION*								
24		ZONE DUCTWORK DEMOLITION	EA.	11.0			1-SHEE	1	$229	$229
25										
26										
27										
28										
29										
30										
31		**SUBTOTAL**				$8,778			$1,275	$10,053
32	OH	OVERHEAD			17%	$1,475			$214	$1,689
33	PRO	PROFIT			10%	$1,025			$149	$1,174
34	CONT	CONTINGENCY			20%	$2,256			$328	$2,583
35	**TOTAL COST**		-	-	-	$13,533	-	-	$1,966	$15,500

ENGINEER'S OPINION OF PROBABLE COST

PROJECT	Fort Riley Feasibility Study for HVAC Upgrade	**SHEET**	1 **OF** 1
ENGINEER	E M C Engineers, Inc.	**DATE PREPARED**	4-May-95
	Denver, CO	**ESTIMATOR**	C. Wohlert
		CHECKED BY	A. Niemeyer

Line No.	Item Refer Code	Item Description	Unit of Measure	MATERIAL COST Quantity	MATERIAL COST Unit Cost	MATERIAL COST Total	LABOR COST Crew/ Worker	LABOR COST Hours/ Unit	LABOR COST Total	TOTAL
1		**BUILDING 8025**								
2		**NON-RECURRING**								
3										
4										
5										
6										
7										
8										
9										
10										
11										
12										
13										
14										
15										
16										
17										
18										
19										
20										
21										
22										
23										
24										
25										
26										
27										
28										
29										
30										
31		**SUBTOTAL**				$0			$0	$0
32	OH	OVERHEAD			17%	$0			$0	$0
33	PRO	PROFIT			10%	$0			$0	$0
34	CONT	CONTINGENCY			20%	$0			$0	$0
35	**TOTAL COST**		-	-	-	$0	-	-	$0	$0

ENGINEER'S OPINION OF PROBABLE COST

PROJECT	Fort Riley Feasibility Study for HVAC Upgrade	**SHEET** 1 **OF** 1	
ENGINEER	E M C Engineers, Inc.	**DATE PREPARED**	4-May-95
	Denver, CO	**ESTIMATOR**	C. Wohlert
		CHECKED BY	A. Niemeyer

Line No.	Item Refer Code	Item Description	Unit of Measure	MATERIAL COST Quantity	MATERIAL COST Unit Cost	MATERIAL COST Total	LABOR COST Crew/ Worker	LABOR COST Hours/ Unit	LABOR COST Total	TOTAL
1		**BUILDING 8025**								
2		***ANNUAL RECURRING***								
3		***ANNUAL MAINTENANCE COST - BASELINE***								
4										
5										
6										
7										
8										
9										
10										
11										
12										
13										
14										
15	**TOTAL ANNUAL MAINTENANCE COST - BASELINE**		-	-	-	$0	-	-	$0	$0
16										
17		***ANNUAL MAINTENANCE COST - NEW HVAC REPLACEMENT***								
18										
19										
20										
21										
22										
23										
24										
25										
26										
27										
28										
29	**TOTAL ANNUAL MAINTENANCE COST - BASELINE**		-	-	-	$0	-	-	$0	$0
30										
31										
32										
33										
34										
35	**TOTAL ANNUAL MAINTENANCE COST SAVINGS**		-	-	-	$0	-	-	$0	$0

DEMAND LIMITING ANALYSIS BUILDING 8025

SUMMER PEAK (KW) = 27812	1993 JUL BILL 7/1-8/2 ACTUAL	1993 AUG BILL 8/2-9/1 ACTUAL	1993 SEP BILL 9/3-10/1 ACTUAL	1993 OCT BILL 10/1-11/1 ACTUAL	1993 NOV BILL 11/1-12/1 ACTUAL	1993 DEC BILL 12/1-1/3 ACTUAL	1993 JAN BILL 1/4-2/1 ACTUAL	1993 FEB BILL 2/1-3/1 ACTUAL	1993 MAR BILL 3/3-4/1 ACTUAL	1993 APR BILL 4/1-5/3 ACTUAL	1993 MAY BILL 5/3-6/1 ACTUAL	1993 JUN BILL 6/1-7/1 ACTUAL
BASE CASE												
CAPACITY (KW)	32472	34452	26136	20754	26400	22752	27108	25812	23310	21834	21996	30096
POWER FACTOR (%)	99.20%	99.10%	99.10%	99.90%	99.80%	99.70%	99.50%	99.60%	99.60%	99.80%	99.60%	98.80%
CAPACITY (KVA)	32734	34765	26373	20775	26453	22820	27244	25916	23404	21878	22084	30462
80% SUMMER PEAK (KVA)	27812	27812	27812	27812	27812	27812	27812	27812	27812	27812	27812	27812
CONTRACT MINIMUM (KVA)	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643
BILLING CAPACITY (KVA)	32734	34765	27812	27812	27812	27812	27812	27812	27812	27812	27812	30462
ACTUAL OR 80% PEAK	ACTUAL	ACTUAL	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	ACTUAL
200 KVA @ $4.45	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00
NEXT 400 @ $4.25	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00
REMAINING @ $4.05	$130,142.18	$138,367.78	$110,208.22	$110,208.22	$110,208.22	$110,208.22	$110,208.22	$110,208.22	$110,208.22	$110,208.22	$110,208.22	$120,939.23
SUB DISCOUNT $.20	($6,546.77)	($6,952.98)	($5,562.38)	($5,562.38)	($5,562.38)	($5,562.38)	($5,562.38)	($5,562.38)	($5,562.38)	($5,562.38)	($5,562.38)	($6,092.31)
CAPACITY CHARGE	$126,185.40	$134,004.80	$107,235.84	$107,235.84	$107,235.84	$107,235.84	$107,235.84	$107,235.84	$107,235.84	$107,235.84	$107,235.84	$117,436.92
TOTAL ENERGY (KWH)	16,920,000	16,200,000	10,980,000	10,140,000	11,160,000	12,930,000	12,600,000	12,270,000	12,480,000	11,070,000	9,720,000	13,170,000
50*KVA @ $.03924	$64,223.85	$68,208.70	$54,566.96	$54,566.96	$54,566.96	$54,566.96	$54,566.96	$54,566.96	$54,566.96	$54,566.96	$54,566.96	$59,765.54
100*KVA @ $.03404	$111,426.10	$118,339.66	$94,671.73	$94,671.73	$94,671.73	$94,671.73	$94,671.73	$94,671.73	$94,671.73	$94,671.73	$94,671.73	$103,691.08
250*KVA @ $.03084	$252,378.15	$268,037.26	$209,965.32	$184,059.72	$214,429.80	$214,429.80	$214,429.80	$214,429.80	$214,429.80	$212,740.92	$171,106.92	$234,858.46
EXCESS @ $.02864	$109,589.57	$65,701.49	$0.00	$0.00	$1,009.19	$51,701.99	$42,250.79	$32,799.59	$38,813.99	$0.00	$0.00	$28,221.42
ENERGY CHARGE	$537,617.67	$520,287.11	$359,204.01	$333,298.41	$364,677.69	$415,370.49	$405,919.29	$396,468.09	$402,482.49	$361,979.61	$320,345.61	$426,536.49
TOTAL CHARGE LESS ECA	$663,803.07	$654,291.92	$466,439.85	$440,534.25	$471,913.53	$522,606.33	$513,155.13	$503,703.93	$509,718.33	$469,215.45	$427,581.45	$543,973.42
DEMAND REDUCTION (KW)	**(2.09)**	**(2.11)**	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**(2.06)**
CAPACITY (KW)	32474	34454	26136	20754	26400	22752	27108	25812	23310	21834	21996	30098
POWER FACTOR (%)	99.20%	99.10%	99.10%	99.90%	99.80%	99.70%	99.50%	99.60%	99.60%	99.80%	99.60%	98.80%
CAPACITY (KVA)	32736	34767	26373	20775	26453	22820	27244	25916	23404	21878	22084	30464
80% SUMMER PEAK (KVA)	27814	27814	27814	27814	27814	27814	27814	27814	27814	27814	27814	27814
CONTRACT MINIMUM (KVA)	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643
BILLING CAPACITY (KVA)	32736	34767	27814	27814	27814	27814	27814	27814	27814	27814	27814	30464
ACTUAL OR 80% PEAK	ACTUAL	ACTUAL	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	ACTUAL
200 KVA @ $4.45	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00
NEXT 400 @ $4.25	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00
REMAINING @ $4.05	$130,150.72	$138,376.39	$110,215.11	$110,215.11	$110,215.11	$110,215.11	$110,215.11	$110,215.11	$110,215.11	$110,215.11	$110,215.11	$120,947.69
SUB DISCOUNT $.20	($6,547.20)	($6,953.40)	($5,562.72)	($5,562.72)	($5,562.72)	($5,562.72)	($5,562.72)	($5,562.72)	($5,562.72)	($5,562.72)	($5,562.72)	($6,092.73)
CAPACITY CHARGE	$126,193.52	$134,012.99	$107,242.39	$107,242.39	$107,242.39	$107,242.39	$107,242.39	$107,242.39	$107,242.39	$107,242.39	$107,242.39	$117,444.96
TOTAL ENERGY (KWH)	16,920,000	16,200,000	10,980,000	10,140,000	11,160,000	12,930,000	12,600,000	12,270,000	12,480,000	11,070,000	9,720,000	13,170,000
50*KVA @ $.03924	$64,227.99	$68,212.87	$54,570.30	$54,570.30	$54,570.30	$54,570.30	$54,570.30	$54,570.30	$54,570.30	$54,570.30	$54,570.30	$59,769.63
100*KVA @ $.03404	$111,433.28	$118,346.90	$94,677.52	$94,677.52	$94,677.52	$94,677.52	$94,677.52	$94,677.52	$94,677.52	$94,677.52	$94,677.52	$103,698.18
250*KVA @ $.03084	$252,394.41	$268,053.64	$209,957.45	$184,051.85	$214,442.92	$214,442.92	$214,442.92	$214,442.92	$214,442.92	$212,733.05	$171,099.05	$234,874.56
EXCESS @ $.02864	$109,565.41	$65,677.14	$0.00	$0.00	$989.71	$51,682.51	$42,231.31	$32,780.11	$38,794.51	$0.00	$0.00	$28,197.50
ENERGY CHARGE	$537,621.09	$520,290.56	$359,205.27	$333,299.67	$364,680.44	$415,373.24	$405,922.04	$396,470.84	$402,485.24	$361,980.87	$320,346.87	$426,539.87
TOTAL CHARGE LESS ECA	$663,814.61	$654,303.54	$466,447.66	$440,542.06	$471,922.83	$522,615.63	$513,164.43	$503,713.23	$509,727.63	$469,223.26	$427,589.26	$543,984.83
SUMMARY												
MONTHLY DIFFERENCE	($11.54)	($11.63)	($7.81)	($7.81)	($9.30)	($9.30)	($9.30)	($9.30)	($9.30)	($7.81)	($7.81)	($11.42)
ANNUAL DIFFERENCE..............		**($112)**										

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EMC       ENGINEERS      INC.        EZDOE - ELITE SOFTWARE DEVELOPMENT INC       DOE-2.1D   5/ 2/1995      9:49:43  LDL RUN 1
DENVER,        CO       80227        EXISTING CONDITION OF BLDG. 8025           BN ADMIN & CLRM
REPORT- LV-D  DETAILS OF EXTERIOR SURFACES IN THE PROJECT                               TOPEKA, KS
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NUMBER OF EXTERIOR SURFACES 13 RECTANGULAR 13 OTHER 0
(U-VALUE INCLUDES INSIDE AIR FILM PLUS OUTSIDE AIR FILM AT 7.5 MPH WINDSPEED)

SURFACE	SPACE	GLASS U-VALUE (BTU/HR-SQFT-F)	GLASS AREA (SQFT)	WALL U-VALUE (BTU/HR-SQFT-F)	WALL AREA (SQFT)	WALL+GLASS U-VALUE (BTU/HR-SQFT-F)	WALL+GLASS AREA (SQFT)	AZIMUTH
	SPACE_1	0.000	0.00	0.065	294.50	0.065	294.50	NORTH
	SPACE_3	0.000	0.00	0.065	558.00	0.065	558.00	NORTH
	SPACE_4	0.000	0.00	0.065	341.00	0.065	341.00	NORTH
	SPACE_1	0.490	133.65	0.103	1834.85	0.129	1968.50	EAST
	SPACE_4	0.000	0.00	0.103	651.00	0.103	651.00	EAST
	SPACE_2	0.000	0.00	0.065	651.00	0.065	651.00	SOUTH
	SPACE_1	0.000	0.00	0.065	558.00	0.065	558.00	SOUTH
	SPACE_3	0.490	29.70	0.103	1380.80	0.111	1410.50	WEST
	SPACE_2	0.490	74.25	0.103	1119.25	0.127	1193.50	WEST
	SPACE_3	0.000	0.00	0.128	3570.00	0.128	3570.00	ROOF
	SPACE_1	0.000	0.00	0.128	4445.00	0.128	4445.00	ROOF
	SPACE_2	0.000	0.00	0.128	3234.00	0.128	3234.00	ROOF
	SPACE_4	0.000	0.00	0.128	924.00	0.128	924.00	ROOF
	SPACE_1	0.000	0.00	0.020	4445.00	0.020	4445.00	UNDERGRND
	SPACE_2	0.000	0.00	0.020	3234.00	0.020	3234.00	UNDERGRND
	SPACE_3	0.000	0.00	0.020	3570.00	0.020	3570.00	UNDERGRND
	SPACE_4	0.000	0.00	0.020	924.00	0.020	924.00	UNDERGRND


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EMC       ENGINEERS      INC.        EZDOE - ELITE SOFTWARE DEVELOPMENT INC       DOE-2.1D   5/ 2/1995      9:49:43  LDL RUN 1
DENVER,        CO       80227        EXISTING CONDITION OF BLDG. 8025           BN ADMIN & CLRM
REPORT- LV-D  DETAILS OF EXTERIOR SURFACES IN THE PROJECT                               TOPEKA, KS
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	AVERAGE U-VALUE/GLASS (BTU/HR-SQFT-F)	AVERAGE U-VALUE/WALLS (BTU/HR-SQFT-F)	AVERAGE U-VALUE WALLS+GLASS (BTU/HR-SQFT-F)	GLASS AREA (SQFT)	OPAQUE AREA (SQFT)	GLASS+OPAQUE AREA (SQFT)
NORTH	0.000	0.065	0.065	0.00	1193.50	1193.50
EAST	0.490	0.103	0.123	133.65	2485.85	2619.50
SOUTH	0.000	0.065	0.065	0.00	1209.00	1209.00
WEST	0.490	0.103	0.119	103.95	2500.05	2604.00
ROOF	0.000	0.128	0.128	0.00	12173.00	12173.00
ALL WALLS	0.490	0.091	0.103	237.60	7388.40	7626.00
WALLS+ROOFS	0.490	0.114	0.118	237.60	19561.40	19799.00
UNDERGRND	0.000	0.020	0.020	0.00	12173.00	12173.00
BUILDING	0.490	0.078	0.081	237.60	31734.40	31972.00

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    EMC       ENGINEERS      INC.         EZDOE - ELITE SOFTWARE DEVELOPMENT INC       DOE-2.1D   5/ 2/1995      9:49:43  LDL RUN 1
    DENVER,       CO         80227        EXISTING CONDITION OF BLDG. 8025          BN ADMIN & CLRM
REPORT- LS-C BUILDING PEAK LOAD COMPONENTS                                                TOPEKA, KS
-----------------------------------------------------------------------------------------------------------------

*** BUILDING ***

                  FLOOR  AREA      12179  SQFT      1131  SQMT
                  VOLUME          188775  CUFT      5346  CUMT

                                    COOLING  LOAD                                 HEATING  LOAD
                                 ====================                          ====================
              TIME                  AUG  4   5PM                                  OCT  1   8AM
              DRY-BULB TEMP          92F     33C                                    47F      8C
              WET-BULB TEMP          70F     21C                                    45F      7C

                             SENSIBLE              LATENT                          SENSIBLE
                         (KBTU/H)   ( KW )    (KBTU/H)   ( KW )               (KBTU/H)   ( KW )
                         --------   ------    --------   ------               --------   --------
    WALLS                   1.434    0.420      0.000     0.000                -15.936    -4.667
    ROOFS                 121.717   35.648      0.000     0.000                -47.801   -14.000
    GLASS CONDUCTION        1.035    0.303      0.000     0.000                 -3.517    -1.030
    GLASS SOLAR             6.967    2.041      0.000     0.000                  0.665     0.195
    DOOR                    2.359    0.691      0.000     0.000                 -2.633    -0.771
    INTERNAL SURFACES       0.000    0.000      0.000     0.000                  0.000     0.000
    UNDERGROUND SURFACES   -1.152   -0.337      0.000     0.000                 -1.788    -0.524
    OCCUPANTS TO SPACE     14.102    4.130     25.373     7.431                  0.656     0.192
    LIGHT     TO SPACE     52.554   15.392      0.000     0.000                  3.796     1.112
    EQUIPMENT TO SPACE      8.974    2.628      0.000     0.000                  0.426     0.125
    PROCESS   TO SPACE      0.000    0.000      0.000     0.000                  0.000     0.000
    INFILTRATION            1.274    0.373      0.595     0.174                 -6.949    -2.035
                         --------  -------    -------    ------               --------   --------
    TOTAL                 209.264   61.288     25.968     7.605                -73.082   -21.404
    TOTAL LOAD            235.231 KBTU/H       68.893    KW             -73.082 KBTU/H     -21.404  KW
    TOTAL LOAD / AREA       19.31BTU/H.SQFT    60.889    W /SQMT          6.001BTU/H.SQFT   18.917   W /SQMT

                          ****************************************************************
                          *                                                              *
                          *  NOTE   1)THE ABOVE LOADS EXCLUDE OUTSIDE VENTILATION AIR    *
                          *  ----     LOADS                                              *
                          *         2)TIMES GIVEN IN STANDARD TIME FOR THE LOCATION      *
                          *           IN CONSIDERATION                                   *
                          *                                                              *
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EMC ENGINEERS INC. EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 5/ 2/1995 9:49:43 SDL RUN 1
DENVER, CO 80227 EXISTING CONDITION OF BLDG. 8025 BN ADMIN & CLRM
REPORT- SS-A SYSTEM MONTHLY LOADS SUMMARY FOR MZ-FAN-SYS TOPEKA, KS

MONTH	COOLING: COOLING ENERGY (MBTU)	TIME OF MAX DY	TIME OF MAX HR	DRY-BULB TEMP	WET-BULB TEMP	MAXIMUM COOLING LOAD (KBTU/HR)	HEATING: HEATING ENERGY (MBTU)	TIME OF MAX DY	TIME OF MAX HR	DRY-BULB TEMP	WET-BULB TEMP	MAXIMUM HEATING LOAD (KBTU/HR)	ELEC: ELECTRICAL ENERGY (KWH)	MAXIMUM ELEC LOAD (KW)
MAY	29.14229	31	18	90.F	76.F	228.157	0.000					0.000	5519.	26.603
JUN	75.11527	28	18	89.F	76.F	232.723	0.000					0.000	10378.	26.603
JUL	93.14638	1	16	86.F	80.F	250.990	0.000					0.000	10050.	26.603
AUG	94.40635	24	17	95.F	77.F	241.699	0.000					0.000	10790.	26.603
SEP	48.48895	6	16	93.F	76.F	231.837	0.000					0.000	10132.	26.603
OCT	0.08540	1	18	83.F	68.F	26.175	0.000					0.000	165.	6.882
TOTAL	340.385						0.000						47035.	
MAX						250.990						0.000		26.603

EMC ENGINEERS INC. EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 5/ 2/1995 9:49:43 SDL RUN 1
DENVER, CO 80227 EXISTING CONDITION OF BLDG. 8025 BN ADMIN & CLRM
REPORT- SS-C SYSTEM MONTHLY LOAD HOURS FOR MZ-FAN-SYS TOPEKA, KS

D4-27

MONTH	NUMBER OF HOURS: HOURS COOLING LOAD	HOURS HEATING LOAD	HOURS COINCIDENT COOL-HEAT LOAD	HOURS FLOATING	HOURS HEATING AVAIL.	HOURS COOLING AVAIL.	HOURS FANS ON	HOURS FANS CYCLE ON	HOURS NIGHT VENTING	HOURS FLOATING WHEN FANS ON	COINCIDENT LOADS: HEATING LOAD AT COOLING PEAK (KBTU/HR)	ELECTRIC LOAD AT COOLING PEAK (KW)
MAY	353	0	0	55	0	384	408	0	0	55	0.000	26.603
JUN	693	0	0	27	0	720	720	0	0	27	0.000	26.603
JUL	744	0	0	0	0	744	744	0	0	0	0.000	26.603
AUG	744	0	0	0	0	744	744	0	0	0	0.000	26.603
SEP	548	0	0	172	0	720	720	0	0	172	0.000	26.603
OCT	6	0	0	18	0	24	24	0	0	18	0.000	6.882
ANNUAL	3088	0	0	272	0	3336	3360	0	0	272		

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EMC        ENGINEERS      INC.       EZDOE - ELITE SOFTWARE DEVELOPMENT INC        DOE-2.1D   5/ 2/1995      9:49:43  PDL RUN 1
DENVER,       CO         80227       EXISTING CONDITION OF BLDG. 8025          BN ADMIN & CLRM
REPORT- PS-B  MONTHLY PEAK AND TOTAL ENERGY USE                                    TOPEKA, KS
```

MO	UTILITY-	ELECTRICITY	NATURAL-GAS
	TOTAL(MBTU)	29.231	0.000
MAY	PEAK(KBTU)	167.446	0.000
	DY/HR	31/18	31/ 1
	TOTAL(MBTU)	61.398	0.000
JUN	PEAK(KBTU)	168.204	0.000
	DY/HR	28/17	30/ 1
	TOTAL(MBTU)	66.355	0.000
JUL	PEAK(KBTU)	172.908	0.000
	DY/HR	22/18	31/ 1
	TOTAL(MBTU)	70.188	0.000
AUG	PEAK(KBTU)	174.663	0.000
	DY/HR	23/16	31/ 1
	TOTAL(MBTU)	51.944	0.000
SEP	PEAK(KBTU)	170.663	0.000
	DY/HR	6/16	30/ 1
	TOTAL(MBTU)	0.627	0.000
OCT	PEAK(KBTU)	40.146	0.000
	DY/HR	1/18	1/ 1
	ONE YEAR	279.742	0.000
	USE/PEAK	174.663	0.000

D4-28

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EMC        ENGINEERS      INC.       EZDOE - ELITE SOFTWARE DEVELOPMENT INC        DOE-2.1D   5/ 2/1995      9:49:43  PDL RUN 1
DENVER,       CO         80227       EXISTING CONDITION OF BLDG. 8025          BN ADMIN & CLRM
REPORT- BEPS  ESTIMATED BUILDING ENERGY PERFORMANCE                                TOPEKA, KS
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ENERGY TYPE IN SITE MBTU - CATEGORY OF USE	ELECTRICITY	NATURAL-GAS
SPACE HEAT	0.00	0.00
SPACE COOL	114.55	0.00
HVAC AUX	83.55	0.00
DOM HOT WTR	0.00	0.00
AUX SOLAR	0.00	0.00
LIGHTS	70.06	0.00
VERT TRANS	0.00	0.00
MISC EQUIP	11.59	0.00
TOTAL	279.74	0.00

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TOTAL SITE ENERGY        279.74 MBTU     22.8 KBTU/SQFT-YR GROSS-AREA     23.0 KBTU/SQFT-YR NET-AREA
TOTAL SOURCE ENERGY      840.07 MBTU     68.4 KBTU/SQFT-YR GROSS-AREA     69.0 KBTU/SQFT-YR NET-AREA
PERCENT OF HOURS ANY SYSTEM ZONE OUTSIDE OF THROTTLING RANGE =  7.7
PERCENT OF HOURS ANY PLANT LOAD NOT SATISFIED                =  0.0
NOTE  ELECTRICITY AND/OR FUEL USED TO GENERATE ELECTRICITY IS APPORTIONED BASED
      ON THE YEARLY DEMAND.  ALL OTHER ENERGY TYPES ARE APPORTIONED HOURLY.
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EMC ENGINEERS INC. DENVER, CO 80227 — EZDOE - ELITE SOFTWARE DEVELOPMENT INC — DOE-2.1D 5/ 2/1995 9:51:26 SDL RUN 1

PROPOSED MODIFICATION OF BLDG. 8025 — BN ADMIN & CLRM — TOPEKA, KS

REPORT- SS-A SYSTEM MONTHLY LOADS SUMMARY FOR MZ-FAN-SYS

MONTH	COOLING: COOLING ENERGY (MBTU)	COOLING: TIME OF MAX DY	COOLING: TIME OF MAX HR	COOLING: DRY-BULB TEMP	COOLING: WET-BULB TEMP	COOLING: MAXIMUM COOLING LOAD (KBTU/HR)	HEATING: HEATING ENERGY (MBTU)	HEATING: TIME OF MAX DY	HEATING: TIME OF MAX HR	HEATING: DRY-BULB TEMP	HEATING: WET-BULB TEMP	HEATING: MAXIMUM HEATING LOAD (KBTU/HR)	ELEC: ELEC-TRICAL ENERGY (KWH)	ELEC: MAXIMUM ELEC LOAD (KW)
MAY	20.32384	31	18	90.F	76.F	229.498	0.000					0.000	3215.	28.237
JUN	59.24684	28	18	89.F	76.F	238.459	0.000					0.000	6919.	28.237
JUL	77.20629	1	16	86.F	80.F	257.113	0.000					0.000	6888.	28.237
AUG	79.84695	24	17	95.F	77.F	247.517	0.000					0.000	7883.	28.237
SEP	36.72924	7	15	92.F	76.F	237.263	0.000					0.000	6024.	28.237
OCT	0.48520	1	17	85.F	68.F	39.558	0.000					0.000	9.	0.392
TOTAL	273.838						0.000						30939.	
MAX						257.113						0.000		28.237

EMC ENGINEERS INC. DENVER, CO 80227 — EZDOE - ELITE SOFTWARE DEVELOPMENT INC — DOE-2.1D 5/ 2/1995 9:51:26 SDL RUN 1

PROPOSED MODIFICATION OF BLDG. 8025 — BN ADMIN & CLRM — TOPEKA, KS

REPORT- SS-C SYSTEM MONTHLY LOAD HOURS FOR MZ-FAN-SYS

D4-29

MONTH	HOURS COOLING LOAD	HOURS HEATING LOAD	HOURS COINCIDENT COOL-HEAT LOAD	HOURS FLOATING	HOURS HEATING AVAIL.	HOURS COOLING AVAIL.	HOURS FANS ON	HOURS FANS CYCLE ON	HOURS NIGHT VENTING	HOURS FLOATING WHEN FANS ON	COINCIDENT LOADS: HEATING LOAD AT COOLING PEAK (KBTU/HR)	COINCIDENT LOADS: ELECTRIC LOAD AT COOLING PEAK (KW)
MAY	384	0	0	24	0	384	408	0	0	24	0.000	28.237
JUN	720	0	0	0	0	720	720	0	0	0	0.000	28.237
JUL	744	0	0	0	0	744	744	0	0	0	0.000	28.237
AUG	744	0	0	0	0	744	744	0	0	0	0.000	28.237
SEP	718	0	0	2	0	720	720	0	0	2	0.000	28.237
OCT	24	0	0	0	0	24	24	0	0	0	0.000	0.392
ANNUAL	3334	0	0	26	0	3336	3360	0	0	26		

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    EMC       ENGINEERS      INC.       EZDOE - ELITE SOFTWARE DEVELOPMENT INC       DOE-2.1D   5/ 2/1995     9:51:26  PDL RUN 1
   DENVER,       CO         80227       PROPOSED MODIFICATION OF BLDG. 8025     BN ADMIN & CLRM
REPORT- PS-B  MONTHLY PEAK AND TOTAL ENERGY USE                                      TOPEKA, KS
--------------------------------------------------------------------------------------------------------------

                 MO      UTILITY-      ELECTRICITY     NATURAL-GAS
                      TOTAL(MBTU)          19.623           0.000
                MAY    PEAK(KBTU)         174.067           0.000
                            DY/HR           31/18           31/ 1
                      TOTAL(MBTU)          45.927           0.000
                JUN    PEAK(KBTU)         175.688           0.000
                            DY/HR           28/17           30/ 1
                      TOTAL(MBTU)          51.608           0.000
                JUL    PEAK(KBTU)         180.500           0.000
                            DY/HR           22/18           31/ 1
                      TOTAL(MBTU)          56.631           0.000
                AUG    PEAK(KBTU)         182.307           0.000
                            DY/HR           23/16           31/ 1
                      TOTAL(MBTU)          36.112           0.000
                SEP    PEAK(KBTU)         178.052           0.000
                            DY/HR            7/16           30/ 1
                      TOTAL(MBTU)           0.329           0.000
                OCT    PEAK(KBTU)          22.660           0.000
                            DY/HR            1/17            1/ 1

                         ONE YEAR         210.229           0.000
                         USE/PEAK         182.307           0.000
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    EMC       ENGINEERS      INC.       EZDOE - ELITE SOFTWARE DEVELOPMENT INC       DOE-2.1D   5/ 2/1995     9:51:26  PDL RUN 1
   DENVER,       CO         80227       PROPOSED MODIFICATION OF BLDG. 8025     BN ADMIN & CLRM
REPORT- BEPS  ESTIMATED BUILDING ENERGY PERFORMANCE                                  TOPEKA, KS
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                             ENERGY TYPE
                              IN SITE MBTU -   ELECTRICITY     NATURAL-GAS
                             CATEGORY OF USE
                                SPACE HEAT          0.00            0.00
                                SPACE COOL         99.50            0.00
                                HVAC AUX           29.08            0.00
                                DOM HOT WTR         0.00            0.00
                                AUX SOLAR           0.00            0.00
                                LIGHTS             70.06            0.00
                                VERT TRANS          0.00            0.00
                                MISC EQUIP         11.59            0.00
                                               ----------      ----------
                                 TOTAL            210.23            0.00

                TOTAL SITE ENERGY       210.23 MBTU     17.1 KBTU/SQFT-YR GROSS-AREA      17.3 KBTU/SQFT-YR NET-AREA
                TOTAL SOURCE ENERGY     631.32 MBTU     51.4 KBTU/SQFT-YR GROSS-AREA      51.8 KBTU/SQFT-YR NET-AREA
                PERCENT OF HOURS ANY SYSTEM ZONE OUTSIDE OF THROTTLING RANGE =  6.8
                PERCENT OF HOURS ANY PLANT LOAD NOT SATISFIED                =  0.0
                NOTE  ELECTRICITY AND/OR FUEL USED TO GENERATE ELECTRICITY IS APPORTIONED BASED
                      ON THE YEARLY DEMAND.  ALL OTHER ENERGY TYPES ARE APPORTIONED HOURLY.
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BUILDING 3
ANNUAL ENERGY SAVINGS SUMMARY

Item	Baseline	ECO	Annual Energy Savings	Adj. Annual Energy Savings*
Annual Electric (MBTU)	395.07	271.93	123.14	136.24
Annual Natural Gas (MBTU)	986.18	794.49	191.69	212.09
Electric Demand June (KW)	42.58	37.07	5.51	6.10
Electric Demand July (KW)	42.60	39.28	3.31	3.67
Electric Demand August (KW)	43.61	41.98	1.63	1.81

*Energy savings prorated on a square foot basis:

Baseline Model Bldg 6 (sq.ft.)	5780
ECO Model Bldg 3 (sq.ft.)	6395
Square Footage Adjustment Factor	1.106

LIFE CYCLE COST ANALYSIS SUMMARY
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

LOCATION:	Fort Riley	REGION: 2 (Kansas)		PROJECT NO:	1406-005
PROJECT TITLE:	Feasibility Study for HVAC Upgrade			FISCAL YEAR:	1995
ANALYSIS DATE:	05/04/95	ECONOMIC LIFE:	20	PREPARED BY:	C. Wohlert

1. INVESTMENT: **BLDG 3 - Replace; STM BLR, Cool Tower, and SZ AHU, w/; HW BLR, ACC, & VAV AHU**

A. CONSTRUCTION COST	=		$61,166	
B. SIOH COST	(5.5% of 1A) =		$3,364	
C. DESIGN COST	(6.0% of 1A) =		$3,670	
D. TOTAL COST	(1A +1B +1C) =		$68,200	
E. SALVAGE VALUE OF EXISTING EQUIPMENT =			$0	
F. PUBLIC UTILITY COMPANY REBATE =			$0	
G. TOTAL INVESTMENT	(1D -1E -1F) =		------->	$68,200

2. ENERGY SAVINGS (+) OR COST (-):

DATE OF NISTR 85-3273-9 USED FOR DISCOUNT FACTORS: JAN '95

ENERGY SOURCE	FUEL COST $/MBTU (1)	SAVINGS MBTU/YR (2)	ANNUAL $ SAVINGS (3)	DISCOUNT FACTOR (4)	DISCOUNTED SAVINGS (5)	
A. ELECT.	$12.10	136	$1,649	15.88	$26,178	
B. DIST	$0.00	0	$0	19.16	$0	
C. NAT GAS	$4.12	212	$874	18.30	$15,991	
D. COAL	$0.00	0	$0	16.62	$0	
E. ELEC. DEMAND			$131	14.88	$1,944	
F. TOTAL		348	$2,653		-------->	$44,113

3. NON-ENERGY SAVINGS (+) OR COST (-)

A. ANNUAL RECURRING (+/-)

1 ANNUAL MAINTENANCE	$724	14.88	$10,770
2	$0	14.88	$0
3	$0	14.88	$0
4 TOTAL ANNUAL DISC. SAVINGS (+) / COST	$724		$10,770

B. NON-RECURRING (+/-)

ITEM	SAVINGS (+) COST(-) (1)	YEAR OF OCCURRENCE (2)	DISCOUNT FACTOR (3) (TABLE A-2)	DISCOUNTED SAVINGS/COST (4)
a. BASELINE EQUIP. REPLACEMEN	$48,583	5	0.863	$41,927
b.				$0
c.				$0
d.				$0
e.				$0
f. TOTAL	$48,583			$41,927

C. TOTAL NON-ENERGY DISCOUNTED SAVINGS (+) OR COST (-) (3A4 + 3Bf4) = $52,697

4. FIRST YEAR DOLLAR SAVINGS (+) / COSTS (-)	(2F3+3A4+(3Bf1/Economic Life))	$5,806
5. SIMPLE PAYBACK (SPB) IN YEARS (MUST BE < 10 YEARS TO QUALIFY)	(1G/4) =	11.75
6. TOTAL NET DISCOUNTED SAVINGS	(2F5 + 3C) =	$96,810
7. DISCOUNTED SAVINGS-TO-INVESTMENT RATIO (SIR) (MUST HAVE SIR > 1.25 TO QUALIFY)	(6/1G) =	1.42

ENGINEER'S OPINION OF PROBABLE COST

PROJECT	Fort Riley Feasibility Study for HVAC Upgrade	SHEET 1 OF 1	
		DATE PREPARED	4-May-95
ENGINEER	E M C Engineers, Inc. Denver, CO	ESTIMATOR	C. Wohlert
		CHECKED BY	A. Niemeyer

Line No.	Item Refer Code	Item Description	Unit of Measure	MATERIAL COST Quantity	MATERIAL COST Unit Cost	MATERIAL COST Total	LABOR COST Crew/ Worker	LABOR COST Hours/ Unit	LABOR COST Total	TOTAL
1		**BUILDING 3**								
2		**PROPOSED SYSTEM MODIFICATIONS**								
3		*NEW SYSTEMS INSTALLATION*								
4	AHU8000	8,000 CFM AHU, COOLING ONLY	EA.	1.0	$4,433	$4,433	Q-6	40.00	$804	$5,237
5	HWBLR4	400 MBH HW BOILER, PWR BURNER, CONTROLS	EA.	1.0	$5,184	$5,184	Q-6	30.00	$603	$5,787
6	WCHLR1	20 TON WATER CHILLER, RECIP., AIR COOLED	EA.	1.0	$11,144	$11,144	Q-7	91.43	$1,879	$13,023
7	STLPIP2.5	STEEL PIPE SCH. 40, 2.5" W/HANGERS	L.F.	40.0	$5.28	$211	Q-15	0.34	$264	$475
8	STLPIP2	STEEL PIPE SCH. 40, 2" W/HANGERS	L.F.	30.0	$3.91	$117	Q-1	0.25	$145	$263
9	STLPIP1.5	STEEL PIPE SCH. 40, 1.5" W/HANGERS	L.F.	98.0	$2.95	$289	Q-1	0.20	$380	$669
10		VALVES AND FITTINGS ADD 15%				$93			$118	$211
11	INSLPIP2.5	2.5" FIBERGLASS PIPE INSULATION, 1.5" THCK	L.F.	40.0	$1.60	$64	Q-14	0.09	$66	$130
12	INSLPIP2	2" FIBERGLASS PIPE INSULATION, 1.5" THCK	L.F.	30.0	$1.46	$44	Q-14	0.08	$46	$90
13	INSLPIP1.5	1.25" FIBERGLASS PIPE INSULATION, 1.5" THCK	L.F.	98.0	$1.40	$137	Q-14	0.08	$144	$281
14	DUCT2000	GAL. STEEL DUCTWORK, 1000 TO 2000 LB.	LB.	1600.0	$0.45	$713	Q-10	0.09	$2,829	$3,542
15	DTINSL0.5	0.5" FIBERGLASS LINER, 2LB DENSITY	S.F.	1200.0	$0.37	$442	Q-14	0.04	$928	$1,370
16	VAVBX12	VAV BOX, 1200 CFM, ELEC	EA.	5.0	$271.32	$1,357	1-SHEE	1.13	$118	$1,474
17	VAVBX35	VAV BOX, 3500 CFM, ELEC	EA.	2.0	$310.08	$620	1-SHEE	1.48	$62	$682
18	REHEAT1.5	REHEAT COIL, 2ROW, 1.5'x1'	EA.	1.0	$129.36	$129	Q-5	1.32	$26	$155
19	REHEAT3	REHEAT COIL, 2ROW, 3'x1'	EA.	2.0	$154.07	$308	Q-5	1.32	$51	$359
20	E-TSTAT1	SINGLE SETPOINT ELEC. TSTAT, 3 WIRE	EA.	5.0	$24.23	$121	1-ELEC	0.80	$84	$205
21	ELCND1	ELECTRICAL CONDUIT 1"	L.F.	50.0	$0.83	$42	1-ELEC	0.06	$67	$109
22	WIRE#6	COPPER WIRING #6	C.L.F.	1.5	$24.71	$37	1-ELEC	1.23	$39	$76
23	WIRE#12	COPPER WIRING #12	C.L.F.	3.0	$7.41	$22	1-ELEC	0.73	$46	$68
24	VSD5	VARIABLE SPEED DRIVE W/ CONTRLER,5HP	EA.	1.0	$2,444.79	$2,445	1-ELEC	10.50	$220	$2,665
25		*EXISTING SYSTEMS DEMOLITION*								
26		BOILER DEMOLITION	EA.	1.0			Q-6	20.00	$402	$402
27		DUCTWORK DEMOLITION	EA.	1.0			Q-5	40.00	$776	$776
28		SZ AHU & H&V UNIT DEMOLITION	TON	3.0			Q-5	14.55	$846	$846
29		COOLING TOWER DEMOLITION	TON	2.0			Q-5	14.55	$564	$564
30		PIPING DEMOLITION	L.F.	250.0			1-PLUM	0.04	$215	$215
31		**SUBTOTAL**				$27,952			$11,721	$39,673
32	OH	OVERHEAD			17%	$4,696			$1,969	$6,665
33	PRO	PROFIT			10%	$3,265			$1,369	$4,634
34	CONT	CONTINGENCY			20%	$7,182			$3,012	$10,194
35	**TOTAL COST**		-	-	-	$43,095	-	-	$18,072	$61,166

ENGINEER'S OPINION OF PROBABLE COST

PROJECT	Fort Riley Feasibility Study for HVAC Upgrade	SHEET 1	OF 1
ENGINEER	E M C Engineers, Inc.	DATE PREPARED	4-May-95
	Denver, CO	ESTIMATOR	C. Wohlert
		CHECKED BY	A. Niemeyer

Line No.	Item Refer Code	Item Description	Unit of Measure	MATERIAL COST Quantity	MATERIAL COST Unit Cost	MATERIAL COST Total	LABOR COST Crew/ Worker	LABOR COST Hours/ Unit	LABOR COST Total	TOTAL
1		**BUILDING 3**								
2		**NON-RECURRING**								
3										
4		*BASELINE - EXISTING EQUIP. REPLACEMENT*								
5	STMBLR2	1,000 MBH STEAM BOILER (Cast Iron)	EA.	1.0	$6,686.10	$6,686	Q-7	80	$1,644	$8,330
6	AHU5400	5,400 CFM AHU, COOLING ONLY	EA.	1.0	$3,803.33	$3,803	Q-6	30	$603	$4,406
7	VNTFAN1	6700 CFM UTILITY FAN, V-BELT DRIVE	EA.	1.0	$1,090.13	$1,090	Q-20	6.667	$128	$1,218
8	CT1	COOLING TOWER, <60 TONS	TON-AC	20.0	$96.90	$1,938	Q-6	23.75	$9,550	$11,488
9	STMCOIL	36X36 STEAM COIL	EA.	1.0	$494.19	$494	Q-5	5.926	$115	$609
10	DTMOD1	MODIFY DUCTWORK FOR STEAM COIL	EA.	1.0	$193.80	$194	Q-5	20	$388	$582
11	STLPIP3	STEEL PIPE SCH. 40, 3" W/HANGERS	L.F.	100.0	$6.40	$640	Q-15	0.372	$721	$1,361
12		VALVES AND FITTINGS ADD 15%				$96			$108	$204
13	INSLPIP3	3" FIBERGLASS PIPE INSULATION, 1.5" THCK	L.F.	100.0	$1.66	$166	Q-14	0.094	$173	$339
14	CUPIP0.7	COPPER PIPE TYPE L, 0.75" W/HANGERS	L.F.	100.0	$1.84	$184	1-PLUM	0.105	$226	$410
15		VALVES AND FITTINGS ADD 15%				$28			$34	$62
16										
17										
18										
19		*EXISTING SYSTEMS DEMOLITION*								
20		BOILER DEMOLITION	EA.	1.0			Q-6	18.00	$362	$362
21		DUCTWORK DEMOLITION	EA.	1.0			Q-5	12.00	$233	$233
22		SZ AHU & H&V UNIT DEMOLITION	TON	4.0			Q-5	14.55	$1,128	$1,128
23		COOLING TOWER DEMOLITION	TON	2.0			Q-5	14.55	$564	$564
24		PIPING DEMOLITION	L.F.	250.0			1-PLUM	0.04	$215	$215
25										
26										
27										
28										
29										
30										
31		**SUBTOTAL**				$15,318			$16,193	$31,512
32	OH	OVERHEAD			17%	$2,573			$2,720	$5,294
33	PRO	PROFIT			10%	$1,789			$1,891	$3,681
34	CONT	CONTINGENCY			20%	$3,936			$4,161	$8,097
35	**TOTAL COST**		-	-	-	$23,617	-	-	$24,966	$48,583

ENGINEER'S OPINION OF PROBABLE COST

PROJECT	Fort Riley Feasibility Study for HVAC Upgrade	**SHEET** 1 **OF** 1	
		DATE PREPARED	4-May-95
ENGINEER	E M C Engineers, Inc.	**ESTIMATOR**	C. Wohlert
	Denver, CO	**CHECKED BY**	A. Niemeyer

Line No.	Item Refer Code	Item Description	Unit of Measure	MATERIAL COST Quantity	Unit Cost	Total	LABOR COST Crew/ Worker	Hours/ Unit	Total	TOTAL
1		**BUILDING 3**								
2		***ANNUAL RECURRING***								
3		***ANNUAL MAINTENANCE COST - BASELINE***								
4	MNT-BLR	MAINT. ON BOILERS - <2.5 MBH	EA.	1.0	$48.45	$48	Q-6	17	$342	$390
5	MNT-AHU	MAINT. ON AHU - INSPEC. / YR > 5000 CFM	EA.	2.0			Q-6	25	$1,005	$1,005
6	MNT-CT1	MAINT. ON CLG TOWER, <20 TONS. / YR (EXISTIN	EA.	1.0			Q-6	15	$302	$302
7										
8										
9										
10										
11										
12										
13										
14										
15	**TOTAL ANNUAL MAINTENANCE COST - BASELINE**		-	-	-	$48	-	-	$1,649	$1,697
16										
17		***ANNUAL MAINTENANCE COST - NEW HVAC REPLACEMENT***								
18	MNT-BLR	MAINT. ON BOILERS - <2.5 MBH	EA.	1.0	$48.45	$48	Q-6	17	$342	$390
19	MNT-AHU	MAINT. ON AHU - INSPEC. / YR <= 5000 CFM	EA.	1.0			Q-6	19	$382	$382
20	MNT-CH1	MAINT. ON CHLR, AIR-CLD, <20 TONS. / YR	EA.	1.0			Q-6	10	$201	$201
21										
22										
23										
24										
25										
26										
27										
28										
29	**TOTAL ANNUAL MAINTENANCE COST - BASELINE**		-	-	-	$48	-	-	$925	$973
30										
31										
32										
33										
34										
35	**TOTAL ANNUAL MAINTENANCE COST SAVINGS**		-	-	-	$0	-	-	$724	$724

DEMAND LIMITING ANALYSIS BUILDING 3

SUMMER PEAK (KW) = 27812	1993 JUL BILL 7/1-8/2 ACTUAL	1993 AUG BILL 8/2-9/1 ACTUAL	1993 SEP BILL 9/3-10/1 ACTUAL	1993 OCT BILL 10/1-11/1 ACTUAL	1993 NOV BILL 11/1-12/1 ACTUAL	1993 DEC BILL 12/1-1/3 ACTUAL	1993 JAN BILL 1/4-2/1 ACTUAL	1993 FEB BILL 2/1-3/1 ACTUAL	1993 MAR BILL 3/3-4/1 ACTUAL	1993 APR BILL 4/1-5/3 ACTUAL	1993 MAY BILL 5/3-6/1 ACTUAL	1993 JUN BILL 6/1-7/1 ACTUAL
BASE CASE												
CAPACITY (KW)	32472	34452	26136	20754	26400	22752	27108	25812	23310	21834	21996	30096
POWER FACTOR (%)	99.20%	99.10%	99.10%	99.90%	99.80%	99.70%	99.50%	99.60%	99.60%	99.80%	99.60%	98.80%
CAPACITY (KVA)	32734	34765	26373	20775	26453	22820	27244	25916	23404	21878	22084	30462
80% SUMMER PEAK (KVA)	27812	27812	27812	27812	27812	27812	27812	27812	27812	27812	27812	27812
CONTRACT MINIMUM (KVA)	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643
BILLING CAPACITY (KVA)	32734	34765	27812	27812	27812	27812	27812	27812	27812	27812	27812	30462
ACTUAL OR 80% PEAK	ACTUAL	ACTUAL	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	ACTUAL
200 KVA @ $4.45	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00
NEXT 400 @ $4.25	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00
REMAINING @ $4.05	$130,142.18	$138,367.78	$110,208.22	$110,208.22	$110,208.22	$110,208.22	$110,208.22	$110,208.22	$110,208.22	$110,208.22	$110,208.22	$120,939.23
SUB DISCOUNT $.20	($6,546.77)	($6,952.98)	($5,562.38)	($5,562.38)	($5,562.38)	($5,562.38)	($5,562.38)	($5,562.38)	($5,562.38)	($5,562.38)	($5,562.38)	($6,092.31)
CAPACITY CHARGE	$126,185.40	$134,004.80	$107,235.84	$107,235.84	$107,235.84	$107,235.84	$107,235.84	$107,235.84	$107,235.84	$107,235.84	$107,235.84	$117,436.92
TOTAL ENERGY (KWH)	16,920,000	16,200,000	10,980,000	10,140,000	11,160,000	12,930,000	12,600,000	12,270,000	12,480,000	11,070,000	9,720,000	13,170,000
50*KVA @ $.03924	$64,223.85	$68,208.70	$54,566.96	$54,566.96	$54,566.96	$54,566.96	$54,566.96	$54,566.96	$54,566.96	$54,566.96	$54,566.96	$59,765.54
100*KVA @ $.03404	$111,426.10	$118,339.66	$94,671.73	$94,671.73	$94,671.73	$94,671.73	$94,671.73	$94,671.73	$94,671.73	$94,671.73	$94,671.73	$103,691.08
250*KVA @ $.03084	$252,378.15	$268,037.26	$209,965.32	$184,059.72	$214,429.80	$214,429.80	$214,429.80	$214,429.80	$214,429.80	$212,740.92	$171,106.92	$234,858.46
EXCESS @ $.02864	$109,589.57	$65,701.49	$0.00	$0.00	$1,009.19	$51,701.99	$42,250.79	$32,799.59	$38,813.99	$0.00	$0.00	$28,221.42
ENERGY CHARGE	$537,617.67	$520,287.11	$359,204.01	$333,298.41	$364,677.69	$415,370.49	$405,919.29	$396,468.09	$402,482.49	$361,979.61	$320,345.61	$426,536.49
TOTAL CHARGE LESS ECA	$663,803.07	$654,291.92	$466,439.85	$440,534.25	$471,913.53	$522,606.33	$513,155.13	$503,703.93	$509,718.33	$469,215.45	$427,581.45	$543,973.42
DEMAND REDUCTION (KW)	**3.67**	**1.81**	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**6.10**
CAPACITY (KW)	32468	34450	26136	20754	26400	22752	27108	25812	23310	21834	21996	30090
POWER FACTOR (%)	99.20%	99.10%	99.10%	99.90%	99.80%	99.70%	99.50%	99.60%	99.60%	99.80%	99.60%	98.80%
CAPACITY (KVA)	32730	34763	26373	20775	26453	22820	27244	25916	23404	21878	22084	30455
80% SUMMER PEAK (KVA)	27810	27810	27810	27810	27810	27810	27810	27810	27810	27810	27810	27810
CONTRACT MINIMUM (KVA)	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643
BILLING CAPACITY (KVA)	32730	34763	27810	27810	27810	27810	27810	27810	27810	27810	27810	30455
ACTUAL OR 80% PEAK	ACTUAL	ACTUAL	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	ACTUAL
200 KVA @ $4.45	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00
NEXT 400 @ $4.25	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00
REMAINING @ $4.05	$130,127.20	$138,360.40	$110,202.32	$110,202.32	$110,202.32	$110,202.32	$110,202.32	$110,202.32	$110,202.32	$110,202.32	$110,202.32	$120,914.25
SUB DISCOUNT $.20	($6,546.03)	($6,952.61)	($5,562.09)	($5,562.09)	($5,562.09)	($5,562.09)	($5,562.09)	($5,562.09)	($5,562.09)	($5,562.09)	($5,562.09)	($6,091.07)
CAPACITY CHARGE	$126,171.17	$133,997.78	$107,230.23	$107,230.23	$107,230.23	$107,230.23	$107,230.23	$107,230.23	$107,230.23	$107,230.23	$107,230.23	$117,413.17
TOTAL ENERGY (KWH)	16,920,000	16,200,000	10,980,000	10,140,000	11,160,000	12,930,000	12,600,000	12,270,000	12,480,000	11,070,000	9,720,000	13,170,000
50*KVA @ $.03924	$64,216.60	$68,205.12	$54,564.10	$54,564.10	$54,564.10	$54,564.10	$54,564.10	$54,564.10	$54,564.10	$54,564.10	$54,564.10	$59,753.43
100*KVA @ $.03404	$111,413.51	$118,333.46	$94,666.77	$94,666.77	$94,666.77	$94,666.77	$94,666.77	$94,666.77	$94,666.77	$94,666.77	$94,666.77	$103,670.08
250*KVA @ $.03084	$252,349.64	$268,023.20	$209,972.07	$184,066.47	$214,418.56	$214,418.56	$214,418.56	$214,418.56	$214,418.56	$212,747.67	$171,113.67	$234,810.90
EXCESS @ $.02864	$109,631.93	$65,722.38	$0.00	$0.00	$1,025.90	$51,718.70	$42,267.50	$32,816.30	$38,830.70	$0.00	$0.00	$28,292.09
ENERGY CHARGE	$537,611.68	$520,284.16	$359,202.93	$333,297.33	$364,675.33	$415,368.13	$405,916.93	$396,465.73	$402,480.13	$361,978.53	$320,344.53	$426,526.50
TOTAL CHARGE LESS ECA	$663,782.85	$654,281.94	$466,433.16	$440,527.56	$471,905.55	$522,598.35	$513,147.15	$503,695.95	$509,710.35	$469,208.76	$427,574.76	$543,939.67
SUMMARY												
MONTHLY DIFFERENCE	$20.22	$9.97	$6.70	$6.70	$7.98	$7.98	$7.98	$7.98	$7.98	$6.70	$6.70	$33.75
ANNUAL DIFFERENCE.............		**$130.62**										

NUMBER OF EXTERIOR SURFACES 10 RECTANGULAR 10 OTHER 0
(U-VALUE INCLUDES INSIDE AIR FILM PLUS OUTSIDE AIR FILM AT 7.5 MPH WINDSPEED)

SURFACE	SPACE	GLASS U-VALUE (BTU/HR-SQFT-F)	GLASS AREA (SQFT)	WALL U-VALUE (BTU/HR-SQFT-F)	WALL AREA (SQFT)	WALL+GLASS U-VALUE (BTU/HR-SQFT-F)	WALL+GLASS AREA (SQFT)	AZIMUTH
	UP-STAIRS	1.021	50.00	0.198	1023.00	0.236	1073.00	NORTH-EAST
	BASEMENT	1.021	27.00	0.198	121.00	0.348	148.00	NORTH-EAST
	UP-STAIRS	1.021	70.00	0.198	1640.00	0.232	1710.00	SOUTH-EAST
	BASEMENT	1.021	63.00	0.198	317.00	0.334	380.00	SOUTH-EAST
	UP-STAIRS	1.021	40.00	0.198	1323.00	0.222	1363.00	SOUTH-WEST
	BASEMENT	1.021	18.00	0.198	170.00	0.277	188.00	SOUTH-WEST
	UP-STAIRS	1.021	100.00	0.198	440.00	0.350	540.00	NORTH-WEST
	BASEMENT	1.021	108.00	0.198	12.00	0.939	120.00	NORTH-WEST
	UP-STAIRS	0.000	0.00	0.103	2850.00	0.103	2850.00	ROOF
	UP-STAIRS	0.000	0.00	0.103	2850.00	0.103	2850.00	ROOF
	BASEMENT	0.000	0.00	0.020	2890.00	0.020	2890.00	UNDERGRND
	BASEMENT	0.000	0.00	0.020	1254.00	0.020	1254.00	UNDERGRND

D5-7

EMC ENGINEERS INC. EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/15/1995 14:19: 6 LDL RUN 1
DENVER, CO 80227 EXISTING CONDITION OF BLDG. 3 POST CHAPEL
REPORT- LV-D DETAILS OF EXTERIOR SURFACES IN THE PROJECT TOPEKA, KS

	AVERAGE U-VALUE/GLASS (BTU/HR-SQFT-F)	AVERAGE U-VALUE/WALLS (BTU/HR-SQFT-F)	AVERAGE U-VALUE WALLS+GLASS (BTU/HR-SQFT-F)	GLASS AREA (SQFT)	OPAQUE AREA (SQFT)	GLASS+OPAQUE AREA (SQFT)
NORTH-EAST	1.021	0.198	0.250	77.00	1144.00	1221.00
SOUTH-EAST	1.021	0.198	0.250	133.00	1957.00	2090.00
SOUTH-WEST	1.021	0.198	0.229	58.00	1493.00	1551.00
NORTH-WEST	1.021	0.198	0.457	208.00	452.00	660.00
ROOF	0.000	0.103	0.103	0.00	5700.00	5700.00
ALL WALLS	1.021	0.198	0.269	476.00	5046.00	5522.00
WALLS+ROOFS	1.021	0.148	0.185	476.00	10746.00	11222.00
UNDERGRND	0.000	0.020	0.020	0.00	4144.00	4144.00
BUILDING	1.021	0.112	0.140	476.00	14890.00	15366.00

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   EMC      ENGINEERS      INC.       EZDOE - ELITE SOFTWARE DEVELOPMENT INC       DOE-2.1D   2/15/1995    14:19: 6  LDL RUN 1
   DENVER,        CO      80227       EXISTING CONDITION OF BLDG. 3            POST CHAPEL
REPORT- LS-C BUILDING PEAK LOAD COMPONENTS                                           TOPEKA, KS
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*** BUILDING ***

                  FLOOR  AREA      5780  SQFT       537  SQMT
                  VOLUME         112710  CUFT      3192  CUMT

                                    COOLING  LOAD                                 HEATING  LOAD
                                ====================                          ====================
              TIME                  AUG 21 11AM                                  JAN 16   6AM
              DRY-BULB TEMP           88F     31C                                   10F    -12C
              WET-BULB TEMP           76F     24C                                    8F    -13C

                              SENSIBLE           LATENT                              SENSIBLE
                          (KBTU/H)   ( KW )  (KBTU/H)  ( KW )                    (KBTU/H)   ( KW )
                          --------   ------  --------  ------                    --------  --------
   WALLS                    16.972    4.971     0.000   0.000                    -101.307   -29.670
   ROOFS                     0.000    0.000     0.000   0.000                       0.000     0.000
   GLASS CONDUCTION          5.259    1.540     0.000   0.000                     -36.212   -10.606
   GLASS SOLAR              14.045    4.114     0.000   0.000                       1.997     0.585
   DOOR                      2.209    0.647     0.000   0.000                      -4.649    -1.362
   INTERNAL SURFACES         0.000    0.000     0.000   0.000                       0.000     0.000
   UNDERGROUND SURFACES     -0.392   -0.115     0.000   0.000                      -2.380    -0.697
   OCCUPANTS TO SPACE       68.054   19.931   156.250  45.762                       0.879     0.258
   LIGHT     TO SPACE       15.492    4.537     0.000   0.000                       5.193     1.521
   EQUIPMENT TO SPACE        0.000    0.000     0.000   0.000                       0.000     0.000
   PROCESS   TO SPACE        0.000    0.000     0.000   0.000                       0.000     0.000
   INFILTRATION              4.875    1.428    11.614   3.401                     -28.961    -8.482
                          --------   ------   -------  ------                    --------  --------
   TOTAL                   126.515   37.053   167.864  49.163                    -165.439   -48.453
   TOTAL LOAD              294.378 KBTU/H      86.216  KW               -165.439 KBTU/H     -48.453  KW
   TOTAL LOAD / AREA         50.93BTU/H.SQFT  160.557  W /SQMT            28.623BTU/H.SQFT   90.232   W /SQMT

                          ****************************************************************
                          *                                                              *
                          *  NOTE   1)THE ABOVE LOADS EXCLUDE OUTSIDE VENTILATION AIR    *
                          *  ----     LOADS                                              *
                          *         2)TIMES GIVEN IN STANDARD TIME FOR THE LOCATION      *
                          *           IN CONSIDERATION                                   *
                          *                                                              *
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EMC ENGINEERS INC. EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/15/1995 14:19: 6 SDL RUN 1
DENVER, CO 80227 EXISTING CONDITION OF BLDG. 3 POST CHAPEL
REPORT- SS-A SYSTEM MONTHLY LOADS SUMMARY FOR PACK-COOLU TOPEKA, KS

	COOLING						HEATING						ELEC	
MONTH	COOLING ENERGY (MBTU)	TIME OF MAX DY	HR	DRY-BULB TEMP	WET-BULB TEMP	MAXIMUM COOLING LOAD (KBTU/HR)	HEATING ENERGY (MBTU)	TIME OF MAX DY	HR	DRY-BULB TEMP	WET-BULB TEMP	MAXIMUM HEATING LOAD (KBTU/HR)	ELEC-TRICAL ENERGY (KWH)	MAXIMUM ELEC LOAD (KW)
JAN	0.00000					0.000	-128.137	15	3	-8.F	-9.F	-287.154	6149.	10.598
FEB	0.00000					0.000	-97.728	3	6	-1.F	-2.F	-261.368	5550.	10.598
MAR	0.00000					0.000	-80.561	3	5	15.F	13.F	-215.861	6145.	10.498
APR	0.00000					0.000	-29.201	1	1	32.F	29.F	-146.062	5946.	10.498
MAY	21.43229	30	11	74.F	69.F	262.324	-6.515	5	6	44.F	40.F	-87.142	8687.	38.487
JUN	62.08226	26	11	82.F	74.F	308.517	0.000					0.000	13407.	42.558
JUL	87.59253	24	11	82.F	75.F	317.248	0.000					0.000	16643.	42.582
AUG	83.93900	21	11	88.F	76.F	320.118	0.000					0.000	16612.	43.594
SEP	36.20814	5	11	78.F	73.F	298.893	0.000					0.000	10346.	41.359
OCT	0.10583	1	18	83.F	68.F	32.847	-25.552	20	8	23.F	22.F	-146.262	6159.	15.069
NOV	0.00000					0.000	-65.098	3	4	13.F	12.F	-192.647	5946.	10.498
DEC	0.00000					0.000	-116.063	15	2	3.F	2.F	-264.577	6145.	10.598
TOTAL	291.360						-548.855						107741.	
MAX						320.118						-287.154		43.594

D5-9

EMC ENGINEERS INC. EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/15/1995 14:19: 6 SDL RUN 1
DENVER, CO 80227 EXISTING CONDITION OF BLDG. 3 POST CHAPEL
REPORT- SS-C SYSTEM MONTHLY LOAD HOURS FOR PACK-COOLU TOPEKA, KS

	NUMBER OF HOURS										COINCIDENT LOADS	
MONTH	HOURS COOLING LOAD	HOURS HEATING LOAD	HOURS COINCIDENT COOL-HEAT LOAD	HOURS FLOATING	HOURS HEATING AVAIL.	HOURS COOLING AVAIL.	HOURS FANS ON	HOURS FANS CYCLE ON	HOURS NIGHT VENTING	HOURS FLOATING WHEN FANS ON	HEATING LOAD AT COOLING PEAK (KBTU/HR)	ELECTRIC LOAD AT COOLING PEAK (KW)
JAN	0	744	0	0	744	0	744	0	0	0	-154.749	4.720
FEB	0	672	0	0	672	0	672	0	0	0	-143.819	4.720
MAR	0	743	0	1	744	0	744	0	0	1	-144.966	4.720
APR	0	627	0	93	720	0	720	0	0	93	-43.428	4.720
MAY	340	256	0	148	360	340	744	0	0	148	0.000	38.460
JUN	683	0	0	37	0	683	720	0	0	37	0.000	42.395
JUL	744	0	0	0	0	744	744	0	0	0	0.000	42.582
AUG	744	0	0	0	0	744	744	0	0	0	0.000	43.594
SEP	491	0	0	229	0	496	720	0	0	229	0.000	41.359
OCT	5	600	0	139	720	5	744	0	0	139	0.000	15.069
NOV	0	710	0	10	720	0	720	0	0	10	-161.721	4.720
DEC	0	744	0	0	744	0	744	0	0	0	-171.149	4.720
ANNUAL	3007	5096	0	657	5424	3012	8760	0	0	657		

MO	UTILITY-	ELECTRICITY	NATURAL-GAS
	TOTAL(MBTU)	25.737	216.912
JAN	PEAK(KBTU)	42.565	446.639
	DY/HR	28/ 9	15/ 3
	TOTAL(MBTU)	23.220	171.029
FEB	PEAK(KBTU)	42.565	413.080
	DY/HR	3/ 8	3/ 6
	TOTAL(MBTU)	25.455	148.270
MAR	PEAK(KBTU)	42.224	352.488
	DY/HR	31/20	3/ 5
	TOTAL(MBTU)	22.598	59.671
APR	PEAK(KBTU)	42.224	256.160
	DY/HR	23/ 7	1/ 1
	TOTAL(MBTU)	30.292	14.542
MAY	PEAK(KBTU)	131.412	171.649
	DY/HR	22/11	5/ 6
	TOTAL(MBTU)	45.778	0.000
JUN	PEAK(KBTU)	145.312	0.000
	DY/HR	19/11	30/ 1
	TOTAL(MBTU)	56.827	0.000
JUL	PEAK(KBTU)	145.393	0.000
	DY/HR	24/11	31/ 1
	TOTAL(MBTU)	56.722	0.000
AUG	PEAK(KBTU)	148.847	0.000
	DY/HR	21/11	31/ 1
	TOTAL(MBTU)	35.327	0.000
SEP	PEAK(KBTU)	141.219	0.000
	DY/HR	5/11	30/ 1
	TOTAL(MBTU)	23.203	53.480
OCT	PEAK(KBTU)	51.451	256.442
	DY/HR	1/18	20/ 8
	TOTAL(MBTU)	24.183	122.083
NOV	PEAK(KBTU)	42.224	320.906
	DY/HR	30/20	3/ 4
	TOTAL(MBTU)	25.715	200.189
DEC	PEAK(KBTU)	42.565	417.287
	DY/HR	13/ 8	15/ 2
	ONE YEAR	395.056	986.176
	USE/PEAK	148.847	446.639

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EMC      ENGINEERS     INC.     EZDOE - ELITE SOFTWARE DEVELOPMENT INC      DOE-2.1D   2/15/1995    14:19: 6  PDL RUN 1
  DENVER,     CO       80227    EXISTING CONDITION OF BLDG. 3          POST CHAPEL
REPORT- BEPS ESTIMATED BUILDING ENERGY PERFORMANCE                          TOPEKA, KS
```

ENERGY TYPE IN SITE MBTU - CATEGORY OF USE	ELECTRICITY	NATURAL-GAS
SPACE HEAT	27.19	986.18
SPACE COOL	120.84	0.00
HVAC AUX	141.18	0.00
DOM HOT WTR	0.00	0.00
AUX SOLAR	0.00	0.00
LIGHTS	105.85	0.00
VERT TRANS	0.00	0.00
MISC EQUIP	0.00	0.00
TOTAL	395.07	986.18

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TOTAL SITE ENERGY     1381.23 MBTU    239.0 KBTU/SQFT-YR GROSS-AREA    239.0 KBTU/SQFT-YR NET-AREA
TOTAL SOURCE ENERGY   2172.53 MBTU    375.9 KBTU/SQFT-YR GROSS-AREA    375.9 KBTU/SQFT-YR NET-AREA
PERCENT OF HOURS ANY SYSTEM ZONE OUTSIDE OF THROTTLING RANGE =  0.0
PERCENT OF HOURS ANY PLANT LOAD NOT SATISFIED                =  0.0
NOTE  ELECTRICITY AND/OR FUEL USED TO GENERATE ELECTRICITY IS APPORTIONED BASED
      ON THE YEARLY DEMAND.  ALL OTHER ENERGY TYPES ARE APPORTIONED HOURLY.
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EMC ENGINEERS INC. EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/22/1995 14:42: 5 SDL RUN 1
DENVER, CO 80227 PROPOSED MODIFICATION OF BLDG. 3 POST CHAPEL
REPORT- SS-A SYSTEM MONTHLY LOADS SUMMARY FOR NEW-VAV TOPEKA, KS

	COOLING						HEATING						ELEC	
MONTH	COOLING ENERGY (MBTU)	TIME OF MAX DY	HR	DRY-BULB TEMP	WET-BULB TEMP	MAXIMUM COOLING LOAD (KBTU/HR)	HEATING ENERGY (MBTU)	TIME OF MAX DY	HR	DRY-BULB TEMP	WET-BULB TEMP	MAXIMUM HEATING LOAD (KBTU/HR)	ELEC-TRICAL ENERGY (KWH)	MAXIMUM ELEC LOAD (KW)
JAN	0.00000					0.000	-129.298	15	4	-8.F	-9.F	-270.692	2990.	6.258
FEB	0.00000					0.000	-102.579	3	7	-5.F	-6.F	-255.634	2701.	6.258
MAR	0.00000					0.000	-87.184	3	7	14.F	12.F	-212.124	2990.	6.258
APR	0.00000					0.000	-36.821	1	1	32.F	29.F	-152.512	2933.	8.441
MAY	17.65345	22	11	76.F	65.F	201.106	-9.657	5	6	44.F	40.F	-94.839	3307.	14.489
JUN	50.49638	26	11	82.F	74.F	293.321	0.000					0.000	3252.	10.180
JUL	72.67881	24	11	82.F	75.F	320.906	0.000					0.000	3633.	10.974
AUG	70.08376	21	11	88.F	76.F	332.738	0.000					0.000	3661.	11.228
SEP	32.38507	5	11	78.F	73.F	259.159	0.000					0.000	3077.	9.286
OCT	0.63675	1	17	85.F	68.F	60.281	-33.057	20	8	23.F	22.F	-155.286	3060.	13.096
NOV	0.00000					0.000	-71.874	3	4	13.F	12.F	-202.958	2896.	6.912
DEC	0.00000					0.000	-118.555	13	8	0.F	-1.F	-244.987	2990.	6.258
TOTAL	243.934						-589.027						37490.	
MAX						332.738						-270.692		14.489

D5-12

EMC ENGINEERS INC. EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/22/1995 14:42: 5 SDL RUN 1
DENVER, CO 80227 PROPOSED MODIFICATION OF BLDG. 3 POST CHAPEL
REPORT- SS-C SYSTEM MONTHLY LOAD HOURS FOR NEW-VAV TOPEKA, KS

	NUMBER OF HOURS										COINCIDENT LOADS	
MONTH	HOURS COOLING LOAD	HOURS HEATING LOAD	HOURS COINCIDENT COOL-HEAT LOAD	HOURS FLOATING	HOURS HEATING AVAIL.	HOURS COOLING AVAIL.	HOURS FANS ON	HOURS FANS CYCLE ON	HOURS NIGHT VENTING	HOURS FLOATING WHEN FANS ON	HEATING LOAD AT COOLING PEAK (KBTU/HR)	ELECTRIC LOAD AT COOLING PEAK (KW)
JAN	0	744	0	0	744	0	744	0	0	0	-162.501	0.480
FEB	0	672	0	0	672	0	672	0	0	0	-151.655	0.480
MAR	0	744	0	0	744	0	744	0	0	0	-152.146	0.480
APR	0	689	0	31	720	0	720	0	0	31	-54.825	0.480
MAY	383	281	0	80	360	384	744	0	0	80	0.000	9.015
JUN	716	0	0	4	0	720	720	0	0	4	0.000	10.180
JUL	744	0	0	0	0	744	744	0	0	0	0.000	10.974
AUG	744	0	0	0	0	744	744	0	0	0	0.000	11.228
SEP	654	0	0	66	0	720	720	0	0	66	0.000	9.286
OCT	19	676	0	49	720	24	744	0	0	49	0.000	6.258
NOV	0	720	0	0	720	0	720	0	0	0	-169.711	0.480
DEC	0	744	0	0	744	0	744	0	0	0	-173.751	0.480
ANNUAL	3260	5270	0	230	5424	3336	8760	0	0	230		

EMC ENGINEERS INC. DENVER, CO 80227 — EZDOE - ELITE SOFTWARE DEVELOPMENT INC — DOE-2.1D 2/22/1995 14:42: 5 PDL RUN 1

PROPOSED MODIFICATION OF BLDG. 3 — POST CHAPEL, TOPEKA, KS

REPORT- PS-B MONTHLY PEAK AND TOTAL ENERGY USE

MO	UTILITY-	ELECTRICITY	NATURAL-GAS
	TOTAL(MBTU)	15.417	165.044
JAN	PEAK(KBTU)	28.366	321.545
	DY/HR	31/20	15/ 4
	TOTAL(MBTU)	13.923	134.129
FEB	PEAK(KBTU)	28.366	306.576
	DY/HR	28/20	3/ 7
	TOTAL(MBTU)	15.304	119.268
MAR	PEAK(KBTU)	28.366	262.449
	DY/HR	31/20	3/ 7
	TOTAL(MBTU)	13.433	55.678
APR	PEAK(KBTU)	28.821	199.878
	DY/HR	27/20	1/ 1
	TOTAL(MBTU)	22.760	15.500
MAY	PEAK(KBTU)	100.125	137.018
	DY/HR	22/11	5/ 6
	TOTAL(MBTU)	34.769	0.000
JUN	PEAK(KBTU)	126.510	0.000
	DY/HR	26/11	30/ 1
	TOTAL(MBTU)	41.632	0.000
JUL	PEAK(KBTU)	134.079	0.000
	DY/HR	24/11	31/ 1
	TOTAL(MBTU)	42.095	0.000
AUG	PEAK(KBTU)	143.273	0.000
	DY/HR	21/11	31/ 1
	TOTAL(MBTU)	28.457	0.000
SEP	PEAK(KBTU)	113.783	0.000
	DY/HR	5/11	30/ 1
	TOTAL(MBTU)	14.195	50.876
OCT	PEAK(KBTU)	56.258	202.843
	DY/HR	1/17	20/ 8
	TOTAL(MBTU)	14.523	100.278
NOV	PEAK(KBTU)	28.366	252.986
	DY/HR	30/20	3/ 4
	TOTAL(MBTU)	15.417	153.717
DEC	PEAK(KBTU)	28.366	295.898
	DY/HR	31/20	13/ 8
	ONE YEAR	271.924	794.489
	USE/PEAK	143.273	321.545

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EMC       ENGINEERS       INC.       EZDOE - ELITE SOFTWARE DEVELOPMENT INC        DOE-2.1D   2/22/1995    14:42: 5  PDL RUN 1
   DENVER,      CO        80227      PROPOSED MODIFICATION OF BLDG. 3        POST CHAPEL
REPORT- BEPS  ESTIMATED BUILDING ENERGY PERFORMANCE                                TOPEKA, KS
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ENERGY TYPE IN SITE MBTU - CATEGORY OF USE	ELECTRICITY	NATURAL-GAS
SPACE HEAT	27.39	794.49
SPACE COOL	105.20	0.00
HVAC AUX	33.49	0.00
DOM HOT WTR	0.00	0.00
AUX SOLAR	0.00	0.00
LIGHTS	105.85	0.00
VERT TRANS	0.00	0.00
MISC EQUIP	0.00	0.00
TOTAL	271.93	794.49

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TOTAL SITE ENERGY      1066.41 MBTU    184.5 KBTU/SQFT-YR GROSS-AREA    184.5 KBTU/SQFT-YR NET-AREA
TOTAL SOURCE ENERGY    1611.08 MBTU    278.7 KBTU/SQFT-YR GROSS-AREA    278.7 KBTU/SQFT-YR NET-AREA
PERCENT OF HOURS ANY SYSTEM ZONE OUTSIDE OF THROTTLING RANGE =  6.3
PERCENT OF HOURS ANY PLANT LOAD NOT SATISFIED                =  0.0
NOTE  ELECTRICITY AND/OR FUEL USED TO GENERATE ELECTRICITY IS APPORTIONED BASED
      ON THE YEARLY DEMAND.  ALL OTHER ENERGY TYPES ARE APPORTIONED HOURLY.
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BUILDING 7086
ANNUAL ENERGY SAVINGS SUMMARY

Item	Baseline	ECO	Annual Energy Savings	Adj. Annual Energy Savings*
Annual Electric (MBTU)	461.14	324.59	136.55	136.55
Annual Natural Gas (MBTU)	833.85	711.52	122.33	122.33
Electric Demand June (KW)	38.76	33.52	5.24	5.24
Electric Demand July (KW)	42.06	38.61	3.45	3.45
Electric Demand August (KW)	40.84	37.66	3.18	3.18

*Energy savings prorated on a square foot basis:

Baseline Model Bldg 7086 (sq.ft.)	4590
ECO Model Bldg 7086 (sq.ft.)	4590
Square Footage Adjustment Factor	1.000

LIFE CYCLE COST ANALYSIS SUMMARY
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

LOCATION:	Fort Riley	REGION: 2 (Kansas)		PROJECT NO:	1406-005
PROJECT TITLE:	Feasibility Study for HVAC Upgrade			FISCAL YEAR:	1995
ANALYSIS DATE:	05/04/95	ECONOMIC LIFE:	20	PREPARED BY:	C. Wohlert

1. INVESTMENT: **BLDG 7086 - Replace Existing SZ w/ VAV AHU w/Reheat**

A.	CONSTRUCTION COST	=	$17,292	
B.	SIOH COST	(5.5% of 1A) =	$951	
C.	DESIGN COST	(6.0% of 1A) =	$1,037	
D.	TOTAL COST	(1A +1B +1C) =	$19,280	
E.	SALVAGE VALUE OF EXISTING EQUIPMENT =		$0	
F.	PUBLIC UTILITY COMPANY REBATE =		$0	
G.	TOTAL INVESTMENT	(1D -1E -1F) =	------->	$19,280

2. ENERGY SAVINGS (+) OR COST (-):

DATE OF NISTR 85-3273-9 USED FOR DISCOUNT FACTORS: JAN '95

	ENERGY SOURCE	FUEL COST $/MBTU (1)	SAVINGS MBTU/YR (2)	ANNUAL $ SAVINGS (3)	DISCOUNT FACTOR (4)	DISCOUNTED SAVINGS (5)	
A.	ELECT.	$12.10	92	$1,108	15.88	$17,591	
B.	DIST	$0.00	0	$0	19.16	$0	
C.	NAT GAS	$4.12	122	$504	18.30	$9,223	
D.	COAL	$0.00	0	$0	16.62	$0	
E.	ELEC. DEMAND			$183	14.88	$2,719	
F.	TOTAL		214	$1,794		-------->	$29,533

3. NON-ENERGY SAVINGS (+) OR COST (-)

A. ANNUAL RECURRING (+/-)

1 ANNUAL MAINTENANCE	$0	14.88	$0
2	$0	14.88	$0
3	$0	14.88	$0
4 TOTAL ANNUAL DISC. SAVINGS (+) / COST (-	$0		$0

B. NON-RECURRING (+/-)

ITEM	SAVINGS (+) COST(-) (1)	YEAR OF OCCURRENCE (2)	DISCOUNT FACTOR (3) (TABLE A-2)	DISCOUNTED SAVINGS/COST (4)
a. BASELINE EQUIP. REPLCMNT.	$12,554	5	0.863	$10,834
b.				$0
c.				$0
d. TOTAL	$12,554			$10,834

C. TOTAL NON-ENERGY DISCOUNTED SAVINGS (+) OR COST (-) (3A4 + 3Bd4) = $10,834

4.	FIRST YEAR DOLLAR SAVINGS (+) / COSTS (-)	(2F3+3A4+(3Bd1/Economic Life))	$2,422
5.	SIMPLE PAYBACK (SPB) IN YEARS (MUST BE < 10 YEARS TO QUALIFY)	(1G/4) =	7.96
6.	TOTAL NET DISCOUNTED SAVINGS	(2F5 + 3C) =	$40,367
7.	DISCOUNTED SAVINGS-TO-INVESTMENT RATIO (SIR) (MUST HAVE SIR > 1.25 TO QUALIFY)	(6/1G) =	2.09

ENGINEER'S OPINION OF PROBABLE COST

PROJECT	Fort Riley Feasibility Study for HVAC Upgrade	**SHEET** 1 **OF** 1	
		DATE PREPARED	4-May-95
ENGINEER	E M C Engineers, Inc.	**ESTIMATOR**	C. Wohlert
	Denver, CO	**CHECKED BY**	A. Niemeyer

Line No.	Item Refer Code	Item Description	Unit of Measure	MATERIAL COST Quantity	MATERIAL COST Unit Cost	MATERIAL COST Total	LABOR COST Crew/ Worker	LABOR COST Hours/ Unit	LABOR COST Total	TOTAL
1		**BUILDING 7086**								
2		**PROPOSED SYSTEM MODIFICATIONS**								
3										
4		*NEW SYSTEMS INSTALLATION*								
5	AHU5400	5,400 CFM AHU, COOLING ONLY	EA.	1.0	$3,803.33	$3,803	Q-6	30	$603	$4,406
6	VSD3	VARIABLE SPEED DRIVE W/ CONTRLER,3HP	EA.	1.0	$2,238.39	$2,238	1-ELEC	10.5	$220	$2,458
7	VAVBX35	VAV BOX, 3500 CFM, ELEC	EA.	2.0	$310.08	$620	1-SHEE	1.48	$62	$682
8	REHEAT3	REHEAT COIL, 2ROW, 3'x1'	EA.	2.0	$154.07	$308	Q-5	1.32	$51	$359
9	E-TSTAT1	SINGLE SETPOINT ELEC. TSTAT, 3 WIRE	EA.	2.0	$24.23	$48	1-ELEC	0.8	$33	$82
10	WIRE#12	COPPER WIRING #12	C.L.F.	3.0	$7.41	$22	1-ELEC	0.727	$46	$68
11	STLPIP1	STEEL PIPE SCH. 40, 1" W/HANGERS	L.F.	100.0	$2.10	$210	Q-1	0.151	$293	$503
12		FITTINGS, 5%				$11			$15	$25
13	CNTV1	CONTROL VALVE 1"	EA.	2.0	$190.89	$382	1-PLUM	0.471	$20	$402
14	INSLPIP1	1" FIBERGLASS PIPE INSULATION, 1" THCK	L.F.	100.0	$0.62	$62	Q-14	0.073	$134	$196
15	DUCT1000	GAL. STEEL DUCTWORK, 500 TO 1000 LB.	LB.	500.0	$0.47	$233	Q-10	0.094	$913	$1,146
16	DTINSL2"	DUCT INSLULATION, 2" THICK	S.F.	300.0	$0.83	$250	Q-14	0.053	$293	$543
17										
18										
19										
20										
21										
22										
23		*EXISTING SYSTEM DEMOLITION*								
24		AHU DEMOLITION	TON	1.0			Q-5	17.778	$345	$345
25										
26										
27										
28										
29										
30										
31		**SUBTOTAL**				$8,188			$3,028	$11,216
32	OH	OVERHEAD			17%	$1,376			$509	$1,884
33	PRO	PROFIT			10%	$956			$354	$1,310
34	CONT	CONTINGENCY			20%	$2,104			$778	$2,882
35	**TOTAL COST**		-	-	-	$12,624	-	-	$4,668	$17,292

ENGINEER'S OPINION OF PROBABLE COST

PROJECT	Fort Riley Feasibility Study for HVAC Upgrade	SHEET	1 OF 1
ENGINEER	E M C Engineers, Inc. Denver, CO	DATE PREPARED	4-May-95
		ESTIMATOR	C. Wohlert
		CHECKED BY	A. Niemeyer

Line No.	Item Refer Code	Item Description	Unit of Measure	MATERIAL COST Quantity	MATERIAL COST Unit Cost	MATERIAL COST Total	LABOR COST Crew/ Worker	LABOR COST Hours/ Unit	LABOR COST Total	TOTAL
1		**BUILDING 7086**								
2		**NON-RECURRING**								
3		NEW SYSTEMS INSTALLATION								
4										
5	AHUH5400	5,400 CFM AHU	EA.	1.0	$4,563.99	$4,564	Q-6	31.5	$633	$5,197
6	E-TSTAT1	SINGLE SETPOINT ELEC. TSTAT, 3 WIRE	EA.	1.0	$24.23	$24	1-ELEC	0.8	$17	$41
7	WIRE#12	COPPER WIRING #12	C.L.F.	1.5	$7.41	$11	1-ELEC	0.727	$23	$34
8	STLPIP1	STEEL PIPE SCH. 40, 1" W/HANGERS	L.F.	60.0	$2.10	$126	Q-1	0.151	$176	$302
9		FITTINGS, 5%				$6			$9	$15
10	CNTV1	CONTROL VALVE 1"	EA.	2.0	$190.89	$382	1-PLUM	0.471	$20	$402
11	INSLPIP1	1" FIBERGLASS PIPE INSULATION, 1" THCK	L.F.	60.0	$0.62	$37	Q-14	0.073	$81	$118
12	DUCT1000	GAL. STEEL DUCTWORK, 500 TO 1000 LB.	LB.	500.0	$0.47	$233	Q-10	0.094	$913	$1,146
13	DTINSL2"	DUCT INSLULATION, 2" THICK	S.F.	300.0	$0.83	$250	Q-14	0.053	$293	$543
14										
15										
16										
17										
18										
19										
20										
21										
22		*EXISTING SYSTEM DEMOLITION*								
23		AHU DEMOLITION	TON	1.0			Q-5	17.778	$345	$345
24										
25										
26										
27										
28										
29										
30										
31		**SUBTOTAL**				$5,633			$2,509	$8,142
32	OH	OVERHEAD			17%	$946			$422	$1,368
33	PRO	PROFIT			10%	$658			$293	$951
34	CONT	CONTINGENCY			20%	$1,448			$645	$2,092
35	**TOTAL COST**		-	-	-	$8,685	-	-	$3,868	$12,554

ENGINEER'S OPINION OF PROBABLE COST

PROJECT	Fort Riley Feasibility Study for HVAC Upgrade	SHEET 1 OF 1	
ENGINEER	E M C Engineers, Inc. Denver, CO	DATE PREPARED	4-May-95
		ESTIMATOR	C. Wohlert
		CHECKED BY	A. Niemeyer

Line No.	Item Refer Code	Item Description	Unit of Measure	MATERIAL COST Quantity	MATERIAL COST Unit Cost	MATERIAL COST Total	LABOR COST Crew/ Worker	LABOR COST Hours/ Unit	LABOR COST Total	TOTAL
1		**BUILDING 7086**								
2		***ANNUAL RECURRING***								
3		***ANNUAL MAINTENANCE COST - BASELINE***								
4										
5										
6										
7										
8										
9										
10										
11										
12										
13										
14										
15	**TOTAL ANNUAL MAINTENANCE COST - BASELINE**		-	-	-	$0	-	-	$0	$0
16										
17		***ANNUAL MAINTENANCE COST - NEW HVAC REPLACEMENT***								
18										
19										
20										
21										
22										
23										
24										
25										
26										
27										
28										
29	**TOTAL ANNUAL MAINTENANCE COST - BASELINE**		-	-	-	$0	-	-	$0	$0
30										
31										
32										
33										
34										
35	**TOTAL ANNUAL MAINTENANCE COST SAVINGS**		-	-	-	$0	-	-	$0	$0

DEMAND LIMITING ANALYSIS BUILDING 7086

SUMMER PEAK (KW) = 27812	1993 JUL BILL 7/1-8/2 ACTUAL	1993 AUG BILL 8/2-9/1 ACTUAL	1993 SEP BILL 9/3-10/1 ACTUAL	1993 OCT BILL 10/1-11/1 ACTUAL	1993 NOV BILL 11/1-12/1 ACTUAL	1993 DEC BILL 12/1-1/3 ACTUAL	1993 JAN BILL 1/4-2/1 ACTUAL	1993 FEB BILL 2/1-3/1 ACTUAL	1993 MAR BILL 3/3-4/1 ACTUAL	1993 APR BILL 4/1-5/3 ACTUAL	1993 MAY BILL 5/3-6/1 ACTUAL	1993 JUN BILL 6/1-7/1 ACTUAL
BASE CASE												
CAPACITY (KW)	32472	34452	26136	20754	26400	22752	27108	25812	23310	21834	21996	30096
POWER FACTOR (%)	99.20%	99.10%	99.10%	99.90%	99.80%	99.70%	99.50%	99.60%	99.60%	99.80%	99.60%	98.80%
CAPACITY (KVA)	32734	34765	26373	20775	26453	22820	27244	25916	23404	21878	22084	30462
80% SUMMER PEAK (KVA)	27812	27812	27812	27812	27812	27812	27812	27812	27812	27812	27812	27812
CONTRACT MINIMUM (KVA)	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643
BILLING CAPACITY (KVA)	32734	34765	27812	27812	27812	27812	27812	27812	27812	27812	27812	30462
ACTUAL OR 80% PEAK	ACTUAL	ACTUAL	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	ACTUAL
200 KVA @ $4.45	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00
NEXT 400 @ $4.25	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00
REMAINING @ $4.05	$130,142.18	$138,367.78	$110,208.22	$110,208.22	$110,208.22	$110,208.22	$110,208.22	$110,208.22	$110,208.22	$110,208.22	$110,208.22	$120,939.23
SUB DISCOUNT $.20	($6,546.77)	($6,952.98)	($5,562.38)	($5,562.38)	($5,562.38)	($5,562.38)	($5,562.38)	($5,562.38)	($5,562.38)	($5,562.38)	($5,562.38)	($6,092.31)
CAPACITY CHARGE	$126,185.40	$134,004.80	$107,235.84	$107,235.84	$107,235.84	$107,235.84	$107,235.84	$107,235.84	$107,235.84	$107,235.84	$107,235.84	$117,436.92
TOTAL ENERGY (KWH)	16,920,000	16,200,000	10,980,000	10,140,000	11,160,000	12,930,000	12,600,000	12,270,000	12,480,000	11,070,000	9,720,000	13,170,000
50*KVA @ $.03924	$64,223.85	$68,208.70	$54,566.96	$54,566.96	$54,566.96	$54,566.96	$54,566.96	$54,566.96	$54,566.96	$54,566.96	$54,566.96	$59,765.54
100*KVA @ $.03404	$111,426.10	$118,339.66	$94,671.73	$94,671.73	$94,671.73	$94,671.73	$94,671.73	$94,671.73	$94,671.73	$94,671.73	$94,671.73	$103,691.08
250*KVA @ $.03084	$252,378.15	$268,037.26	$209,965.32	$184,059.72	$214,429.80	$214,429.80	$214,429.80	$214,429.80	$214,429.80	$212,740.92	$171,106.92	$234,858.46
EXCESS @ $.02864	$109,589.57	$65,701.49	$0.00	$0.00	$1,009.19	$51,701.99	$42,250.79	$32,799.59	$38,813.99	$0.00	$0.00	$28,221.42
ENERGY CHARGE	$537,617.67	$520,287.11	$359,204.01	$333,298.41	$364,677.69	$415,370.49	$405,919.29	$396,468.09	$402,482.49	$361,979.61	$320,345.61	$426,536.49
TOTAL CHARGE LESS ECA	$663,803.07	$654,291.92	$466,439.85	$440,534.25	$471,913.53	$522,606.33	$513,155.13	$503,703.93	$509,718.33	$469,215.45	$427,581.45	$543,973.42
DEMAND REDUCTION (KW)	**3.45**	**3.18**	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**5.24**
CAPACITY (KW)	32469	34449	26136	20754	26400	22752	27108	25812	23310	21834	21996	30091
POWER FACTOR (%)	99.20%	99.10%	99.10%	99.90%	99.80%	99.70%	99.50%	99.60%	99.60%	99.80%	99.60%	98.80%
CAPACITY (KVA)	32730	34762	26373	20775	26453	22820	27244	25916	23404	21878	22084	30456
80% SUMMER PEAK (KVA)	27809	27809	27809	27809	27809	27809	27809	27809	27809	27809	27809	27809
CONTRACT MINIMUM (KVA)	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643
BILLING CAPACITY (KVA)	32730	34762	27809	27809	27809	27809	27809	27809	27809	27809	27809	30456
ACTUAL OR 80% PEAK	ACTUAL	ACTUAL	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	ACTUAL
200 KVA @ $4.45	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00
NEXT 400 @ $4.25	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00
REMAINING @ $4.05	$130,128.10	$138,354.80	$110,197.84	$110,197.84	$110,197.84	$110,197.84	$110,197.84	$110,197.84	$110,197.84	$110,197.84	$110,197.84	$120,917.77
SUB DISCOUNT $.20	($6,546.08)	($6,952.34)	($5,561.87)	($5,561.87)	($5,561.87)	($5,561.87)	($5,561.87)	($5,561.87)	($5,561.87)	($5,561.87)	($5,561.87)	($6,091.25)
CAPACITY CHARGE	$126,172.02	$133,992.47	$107,225.97	$107,225.97	$107,225.97	$107,225.97	$107,225.97	$107,225.97	$107,225.97	$107,225.97	$107,225.97	$117,416.52
TOTAL ENERGY (KWH)	16,920,000	16,200,000	10,980,000	10,140,000	11,160,000	12,930,000	12,600,000	12,270,000	12,480,000	11,070,000	9,720,000	13,170,000
50*KVA @ $.03924	$64,217.03	$68,202.41	$54,561.93	$54,561.93	$54,561.93	$54,561.93	$54,561.93	$54,561.93	$54,561.93	$54,561.93	$54,561.93	$59,755.14
100*KVA @ $.03404	$111,414.26	$118,328.76	$94,663.01	$94,663.01	$94,663.01	$94,663.01	$94,663.01	$94,663.01	$94,663.01	$94,663.01	$94,663.01	$103,673.04
250*KVA @ $.03084	$252,351.34	$268,012.55	$209,977.18	$184,071.58	$214,410.04	$214,410.04	$214,410.04	$214,410.04	$214,410.04	$212,752.78	$171,118.78	$234,817.60
EXCESS @ $.02864	$109,629.40	$65,738.20	$0.00	$0.00	$1,038.56	$51,731.36	$42,280.16	$32,828.96	$38,843.36	$0.00	$0.00	$28,282.13
ENERGY CHARGE	$537,612.04	$520,281.92	$359,202.11	$333,296.51	$364,673.54	$415,366.34	$405,915.14	$396,463.94	$402,478.34	$361,977.71	$320,343.71	$426,527.91
TOTAL CHARGE LESS ECA	$663,784.06	$654,274.39	$466,428.09	$440,522.49	$471,899.51	$522,592.31	$513,141.11	$503,689.91	$509,704.31	$469,203.69	$427,569.69	$543,944.43
SUMMARY												
MONTHLY DIFFERENCE	$19.02	$17.53	$11.77	$11.77	$14.02	$14.02	$14.02	$14.02	$14.02	$11.77	$11.77	$28.99
ANNUAL DIFFERENCE.............		**$182.72**										

NUMBER OF EXTERIOR SURFACES 6 RECTANGULAR 6 OTHER 0
(U-VALUE INCLUDES INSIDE AIR FILM PLUS OUTSIDE AIR FILM AT 7.5 MPH WINDSPEED)

		- - - - G L A S S - - - -		- - - - W A L L - - - -		- W A L L + G L A S S -		
SURFACE	SPACE	U-VALUE (BTU/HR-SQFT-F)	AREA (SQFT)	U-VALUE (BTU/HR-SQFT-F)	AREA (SQFT)	U-VALUE (BTU/HR-SQFT-F)	AREA (SQFT)	AZIMUTH
NORTH-WALL	SPACE_1	1.021	468.00	0.118	1714.50	0.312	2182.50	NORTH
EAST-WALL	SPACE_1	0.000	0.00	0.118	1242.00	0.118	1242.00	NORTH-EAST
SOUTH-WALL	SPACE_1	1.021	244.00	0.118	1331.00	0.258	1575.00	SOUTH-EAST
WEST-WALL	SPACE_1	1.021	97.00	0.118	1361.00	0.178	1458.00	SOUTH-WEST
	SPACE_1	0.000	0.00	0.094	2425.00	0.094	2425.00	ROOF
	SPACE_1	0.000	0.00	0.094	3395.00	0.094	3395.00	ROOF
	SPACE_1	0.000	0.00	0.020	4590.00	0.020	4590.00	UNDERGRND

EMC ENGINEERS INC. EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 3/16/1995 8: 7:52 LDL RUN 1
DENVER, CO 80227 EXISTING CONDITION OF BLDG. 7086 UNIT CHAPEL
REPORT- LV-D DETAILS OF EXTERIOR SURFACES IN THE PROJECT TOPEKA, KS

	AVERAGE U-VALUE/GLASS (BTU/HR-SQFT-F)	AVERAGE U-VALUE/WALLS (BTU/HR-SQFT-F)	AVERAGE U-VALUE WALLS+GLASS (BTU/HR-SQFT-F)	GLASS AREA (SQFT)	OPAQUE AREA (SQFT)	GLASS+OPAQUE AREA (SQFT)
NORTH	1.021	0.118	0.312	468.00	1714.50	2182.50
NORTH-EAST	0.000	0.118	0.118	0.00	1242.00	1242.00
SOUTH-EAST	1.021	0.118	0.258	244.00	1331.00	1575.00
SOUTH-WEST	1.021	0.118	0.178	97.00	1361.00	1458.00
ROOF	0.000	0.094	0.094	0.00	5820.00	5820.00
ALL WALLS	1.021	0.118	0.231	809.00	5648.50	6457.50
WALLS+ROOFS	1.021	0.106	0.166	809.00	11468.50	12277.50
UNDERGRND	0.000	0.020	0.020	0.00	4590.00	4590.00
BUILDING	1.021	0.081	0.126	809.00	16058.50	16867.50

*** BUILDING ***

FLOOR AREA	4590	SQFT	426	SQMT
VOLUME	123930	CUFT	3510	CUMT

	COOLING LOAD				HEATING LOAD	
TIME	JUL 23	4PM			JAN 4	3AM
DRY-BULB TEMP	98F	37C			8F	-13C
WET-BULB TEMP	79F	26C			7F	-14C

	SENSIBLE (KBTU/H)	SENSIBLE (KW)	LATENT (KBTU/H)	LATENT (KW)	SENSIBLE (KBTU/H)	SENSIBLE (KW)
WALLS	8.170	2.393	0.000	0.000	-31.018	-9.084
ROOFS	12.808	3.751	0.000	0.000	-32.144	-9.414
GLASS CONDUCTION	22.230	6.511	0.000	0.000	-62.587	-18.330
GLASS SOLAR	9.508	2.785	0.000	0.000	0.436	0.128
DOOR	0.776	0.227	0.000	0.000	-1.512	-0.443
INTERNAL SURFACES	0.000	0.000	0.000	0.000	0.000	0.000
UNDERGROUND SURFACES	-0.824	-0.241	0.000	0.000	-2.636	-0.772
OCCUPANTS TO SPACE	6.543	1.916	9.375	2.746	0.188	0.055
LIGHT TO SPACE	30.393	8.901	0.000	0.000	4.408	1.291
EQUIPMENT TO SPACE	0.000	0.000	0.000	0.000	0.000	0.000
PROCESS TO SPACE	0.000	0.000	0.000	0.000	0.000	0.000
INFILTRATION	12.063	3.533	17.769	5.204	-57.812	-16.932
TOTAL	101.666	29.775	27.144	7.950	-182.676	-53.501
TOTAL LOAD	128.810 KBTU/H		37.725	KW	-182.676 KBTU/H	-53.501 KW
TOTAL LOAD / AREA	28.06BTU/H.SQFT		88.469	W /SQMT	39.799BTU/H.SQFT	125.464 W /SQMT

NOTE
1) THE ABOVE LOADS EXCLUDE OUTSIDE VENTILATION AIR LOADS
2) TIMES GIVEN IN STANDARD TIME FOR THE LOCATION IN CONSIDERATION

EMC ENGINEERS INC. EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 3/16/1995 8: 7:52 SDL RUN 1
DENVER, CO 80227 EXISTING CONDITION OF BLDG. 7086 UNIT CHAPEL
REPORT- SS-A SYSTEM MONTHLY LOADS SUMMARY FOR AC-1 TOPEKA, KS

	COOLING						HEATING						ELEC	
MONTH	COOLING ENERGY (MBTU)	TIME OF MAX DY	HR	DRY-BULB TEMP	WET-BULB TEMP	MAXIMUM COOLING LOAD (KBTU/HR)	HEATING ENERGY (MBTU)	TIME OF MAX DY	HR	DRY-BULB TEMP	WET-BULB TEMP	MAXIMUM HEATING LOAD (KBTU/HR)	ELEC-TRICAL ENERGY (KWH)	MAXIMUM ELEC LOAD (KW)
JAN	0.00000					0.000	-132.870	15	3	-8.F	-9.F	-321.525	7046.	14.737
FEB	0.00000					0.000	-101.107	3	6	-1.F	-2.F	-287.310	6360.	14.737
MAR	0.00000					0.000	-84.020	3	4	16.F	13.F	-252.079	7041.	14.637
APR	0.00000					0.000	-30.302	5	6	31.F	28.F	-161.000	6814.	14.637
MAY	20.62210	31	16	88.F	75.F	191.043	-6.965	5	5	44.F	40.F	-106.771	9025.	34.720
JUN	64.83260	19	10	82.F	74.F	258.862	0.000					0.000	13111.	38.743
JUL	92.03951	24	10	80.F	75.F	277.938	0.000					0.000	15954.	42.044
AUG	89.48664	21	10	86.F	76.F	284.550	0.000					0.000	16048.	40.818
SEP	38.51266	6	16	93.F	76.F	229.718	0.000					0.000	10579.	39.252
OCT	0.16323	1	17	85.F	68.F	55.474	-26.102	20	6	24.F	23.F	-167.285	7059.	20.972
NOV	0.00000					0.000	-66.373	2	6	15.F	14.F	-217.994	6814.	14.637
DEC	0.00000					0.000	-120.204	15	5	8.F	7.F	-290.509	7041.	14.737
TOTAL	305.657						-567.944						112900.	
MAX						284.550						-321.525		42.044

D5-23

EMC ENGINEERS INC. EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 3/16/1995 8: 7:52 SDL RUN 1
DENVER, CO 80227 EXISTING CONDITION OF BLDG. 7086 UNIT CHAPEL
REPORT- SS-C SYSTEM MONTHLY LOAD HOURS FOR AC-1 TOPEKA, KS

	NUMBER OF HOURS										COINCIDENT LOADS	
MONTH	HOURS COOLING LOAD	HOURS HEATING LOAD	HOURS COINCIDENT COOL-HEAT LOAD	HOURS FLOATING	HOURS HEATING AVAIL.	HOURS COOLING AVAIL.	HOURS FANS ON	HOURS FANS CYCLE ON	HOURS NIGHT VENTING	HOURS FLOATING WHEN FANS ON	HEATING LOAD AT COOLING PEAK (KBTU/HR)	ELECTRIC LOAD AT COOLING PEAK (KW)
JAN	0	744	0	0	744	0	744	0	0	0	-159.635	4.543
FEB	0	672	0	0	672	0	672	0	0	0	-157.478	4.543
MAR	0	736	0	8	744	0	744	0	0	8	-158.809	4.543
APR	0	602	0	118	720	0	720	0	0	118	-56.766	4.543
MAY	291	257	0	196	360	293	744	0	0	196	0.000	34.720
JUN	651	0	0	69	0	651	720	0	0	69	0.000	38.743
JUL	740	0	0	4	0	740	744	0	0	4	0.000	39.366
AUG	733	0	0	11	0	733	744	0	0	11	0.000	40.818
SEP	452	0	0	268	0	455	720	0	0	268	0.000	39.252
OCT	4	569	0	171	720	4	744	0	0	171	0.000	20.972
NOV	0	687	0	33	720	0	720	0	0	33	-180.423	4.543
DEC	0	744	0	0	744	0	744	0	0	0	-178.018	4.543
ANNUAL	2871	5011	0	878	5424	2876	8760	0	0	878		

EMC ENGINEERS INC. EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 3/16/1995 8: 7:52 PDL RUN 1
DENVER, CO 80227 EXISTING CONDITION OF BLDG. 7086 UNIT CHAPEL
REPORT- PS-B MONTHLY PEAK AND TOTAL ENERGY USE TOPEKA, KS

MO	UTILITY-	ELECTRICITY	NATURAL-GAS
	TOTAL(MBTU)	29.557	184.608
JAN	PEAK(KBTU)	57.754	405.590
	DY/HR	28/ 9	15/ 3
	TOTAL(MBTU)	26.637	145.332
FEB	PEAK(KBTU)	57.754	369.390
	DY/HR	3/ 8	3/ 6
	TOTAL(MBTU)	29.002	125.834
MAR	PEAK(KBTU)	57.413	331.368
	DY/HR	31/17	3/ 4
	TOTAL(MBTU)	25.781	49.913
APR	PEAK(KBTU)	57.413	229.553
	DY/HR	17/ 8	5/ 6
	TOTAL(MBTU)	31.553	12.528
MAY	PEAK(KBTU)	118.549	166.524
	DY/HR	31/16	5/ 5
	TOTAL(MBTU)	44.766	0.000
JUN	PEAK(KBTU)	132.286	0.000
	DY/HR	19/10	30/ 1
	TOTAL(MBTU)	54.473	0.000
JUL	PEAK(KBTU)	143.556	0.000
	DY/HR	23/16	31/ 1
	TOTAL(MBTU)	54.794	0.000
AUG	PEAK(KBTU)	139.370	0.000
	DY/HR	21/10	31/ 1
	TOTAL(MBTU)	36.121	0.000
SEP	PEAK(KBTU)	134.024	0.000
	DY/HR	6/16	30/ 1
	TOTAL(MBTU)	26.460	44.078
OCT	PEAK(KBTU)	71.608	236.742
	DY/HR	1/17	20/ 6
	TOTAL(MBTU)	27.506	101.395
NOV	PEAK(KBTU)	57.413	293.859
	DY/HR	30/17	2/ 6
	TOTAL(MBTU)	29.494	170.162
DEC	PEAK(KBTU)	57.754	372.805
	DY/HR	13/ 8	15/ 5
	ONE YEAR	416.143	833.850
	USE/PEAK	143.556	405.590

REPORT- BEPS ESTIMATED BUILDING ENERGY PERFORMANCE

ENERGY TYPE IN SITE MBTU - CATEGORY OF USE	ELECTRICITY	NATURAL-GAS
SPACE HEAT	29.19	833.85
SPACE COOL	102.39	0.00
HVAC AUX	137.38	0.00
DOM HOT WTR	0.00	0.00
AUX SOLAR	0.00	0.00
LIGHTS	147.18	0.00
VERT TRANS	0.00	0.00
MISC EQUIP	0.00	0.00
TOTAL	416.14	833.85

TOTAL SITE ENERGY 1249.99 MBTU 272.3 KBTU/SQFT-YR GROSS-AREA 272.3 KBTU/SQFT-YR NET-AREA
TOTAL SOURCE ENERGY 2083.53 MBTU 453.9 KBTU/SQFT-YR GROSS-AREA 453.9 KBTU/SQFT-YR NET-AREA
PERCENT OF HOURS ANY SYSTEM ZONE OUTSIDE OF THROTTLING RANGE = 0.0
PERCENT OF HOURS ANY PLANT LOAD NOT SATISFIED = 0.0
NOTE ELECTRICITY AND/OR FUEL USED TO GENERATE ELECTRICITY IS APPORTIONED BASED ON THE YEARLY DEMAND. ALL OTHER ENERGY TYPES ARE APPORTIONED HOURLY.

EMC ENGINEERS INC. EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/23/1995 9: 1: 2 SDL RUN 1
DENVER, CO 80227 PROPOSED MODIFICATION OF BLDG. 7086 UNIT CHAPEL
REPORT- SS-A SYSTEM MONTHLY LOADS SUMMARY FOR VAV-1 TOPEKA, KS

MONTH	COOLING: COOLING ENERGY (MBTU)	COOLING: TIME OF MAX DY	COOLING: TIME OF MAX HR	COOLING: DRY-BULB TEMP	COOLING: WET-BULB TEMP	COOLING: MAXIMUM COOLING LOAD (KBTU/HR)	HEATING: HEATING ENERGY (MBTU)	HEATING: TIME OF MAX DY	HEATING: TIME OF MAX HR	HEATING: DRY-BULB TEMP	HEATING: WET-BULB TEMP	HEATING: MAXIMUM HEATING LOAD (KBTU/HR)	ELEC: ELEC-TRICAL ENERGY (KWH)	ELEC: MAXIMUM ELEC LOAD (KW)
JAN	0.00000					0.000	-108.898	15	4	-8.F	-9.F	-221.888	5327.	12.333
FEB	0.00000					0.000	-88.874	3	7	-5.F	-6.F	-210.100	4811.	12.333
MAR	0.00000					0.000	-76.273	4	6	14.F	12.F	-174.148	5327.	12.333
APR	0.00000					0.000	-30.855	5	7	30.F	27.F	-141.563	5356.	18.478
MAY	14.95665	31	16	88.F	75.F	143.635	-7.685	5	5	44.F	40.F	-99.952	5648.	18.478
JUN	44.24454	19	10	82.F	74.F	216.876	0.000					0.000	5185.	13.611
JUL	62.78404	24	10	80.F	75.F	248.546	0.000					0.000	5395.	15.089
AUG	62.74154	21	10	86.F	76.F	254.689	0.000					0.000	5452.	15.150
SEP	28.79925	6	16	93.F	76.F	186.148	0.000					0.000	5179.	14.281
OCT	0.56231	1	17	85.F	68.F	51.632	-26.972	20	6	24.F	23.F	-152.372	5653.	18.478
NOV	0.00000					0.000	-62.157	3	5	13.F	12.F	-172.246	5200.	18.478
DEC	0.00000					0.000	-101.031	13	8	0.F	-1.F	-201.802	5327.	12.333
TOTAL	214.088						-502.745						63857.	
MAX						254.689						-221.888		18.478

EMC ENGINEERS INC. EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/23/1995 9: 1: 2 SDL RUN 1
DENVER, CO 80227 PROPOSED MODIFICATION OF BLDG. 7086 UNIT CHAPEL
REPORT- SS-C SYSTEM MONTHLY LOAD HOURS FOR VAV-1 TOPEKA, KS

MONTH	HOURS COOLING LOAD	HOURS HEATING LOAD	HOURS COINCIDENT COOL-HEAT LOAD	HOURS FLOATING	HOURS HEATING AVAIL.	HOURS COOLING AVAIL.	HOURS FANS ON	HOURS FANS CYCLE ON	HOURS NIGHT VENTING	HOURS FLOATING WHEN FANS ON	COINCIDENT LOADS: HEATING LOAD AT COOLING PEAK (KBTU/HR)	COINCIDENT LOADS: ELECTRIC LOAD AT COOLING PEAK (KW)
JAN	0	744	0	0	744	0	744	0	0	0	-137.583	2.239
FEB	0	672	0	0	672	0	672	0	0	0	-139.303	2.239
MAR	0	741	0	3	744	0	744	0	0	3	-137.559	2.239
APR	0	620	0	100	720	0	720	0	0	100	-55.470	2.239
MAY	384	245	0	115	360	384	744	0	0	115	0.000	12.604
JUN	720	0	0	0	0	720	720	0	0	0	0.000	13.611
JUL	744	0	0	0	0	744	744	0	0	0	0.000	14.763
AUG	744	0	0	0	0	744	744	0	0	0	0.000	14.868
SEP	682	0	0	38	0	720	720	0	0	38	0.000	14.281
OCT	20	582	0	142	720	24	744	0	0	142	0.000	12.333
NOV	0	700	0	20	720	0	720	0	0	20	-149.868	2.239
DEC	0	744	0	0	744	0	744	0	0	0	-145.648	2.239
ANNUAL	3294	5048	0	418	5424	3336	8760	0	0	418		

EMC ENGINEERS INC. EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/23/1995 9: 1: 2 PDL RUN 1
DENVER, CO 80227 PROPOSED MODIFICATION OF BLDG. 7086 UNIT CHAPEL
REPORT- PS-B MONTHLY PEAK AND TOTAL ENERGY USE TOPEKA, KS

MO	UTILITY-	ELECTRICITY	NATURAL-GAS
	TOTAL(MBTU)	22.006	147.115
JAN	PEAK(KBTU)	47.241	279.902
	DY/HR	31/17	15/ 4
	TOTAL(MBTU)	19.864	122.308
FEB	PEAK(KBTU)	47.241	267.492
	DY/HR	28/17	3/ 7
	TOTAL(MBTU)	21.816	109.022
MAR	PEAK(KBTU)	47.241	228.882
	DY/HR	31/17	4/ 6
	TOTAL(MBTU)	20.454	48.360
APR	PEAK(KBTU)	63.093	192.899
	DY/HR	3/10	5/ 7
	TOTAL(MBTU)	26.553	12.973
MAY	PEAK(KBTU)	99.317	145.581
	DY/HR	31/16	5/ 5
	TOTAL(MBTU)	35.268	0.000
JUN	PEAK(KBTU)	114.415	0.000
	DY/HR	19/10	30/ 1
	TOTAL(MBTU)	41.549	0.000
JUL	PEAK(KBTU)	131.786	0.000
	DY/HR	23/16	31/ 1
	TOTAL(MBTU)	42.499	0.000
AUG	PEAK(KBTU)	128.531	0.000
	DY/HR	21/10	31/ 1
	TOTAL(MBTU)	29.999	0.000
SEP	PEAK(KBTU)	118.250	0.000
	DY/HR	6/16	30/ 1
	TOTAL(MBTU)	21.628	43.145
OCT	PEAK(KBTU)	65.519	204.940
	DY/HR	1/17	20/ 6
	TOTAL(MBTU)	20.945	90.278
NOV	PEAK(KBTU)	63.093	226.808
	DY/HR	22/16	3/ 5
	TOTAL(MBTU)	22.002	138.319
DEC	PEAK(KBTU)	47.241	258.682
	DY/HR	31/17	13/ 8
	ONE YEAR	324.583	711.519
	USE/PEAK	131.786	279.902

ENERGY TYPE IN SITE MBTU - CATEGORY OF USE	ELECTRICITY	NATURAL-GAS
SPACE HEAT	21.76	711.52
SPACE COOL	81.42	0.00
HVAC AUX	74.24	0.00
DOM HOT WTR	0.00	0.00
AUX SOLAR	0.00	0.00
LIGHTS	147.18	0.00
VERT TRANS	0.00	0.00
MISC EQUIP	0.00	0.00
TOTAL	324.59	711.52

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TOTAL SITE ENERGY      1036.10 MBTU    225.7 KBTU/SQFT-YR GROSS-AREA    225.7 KBTU/SQFT-YR NET-AREA
TOTAL SOURCE ENERGY    1686.24 MBTU    367.4 KBTU/SQFT-YR GROSS-AREA    367.4 KBTU/SQFT-YR NET-AREA
PERCENT OF HOURS ANY SYSTEM ZONE OUTSIDE OF THROTTLING RANGE = 22.6
PERCENT OF HOURS ANY PLANT LOAD NOT SATISFIED                =  0.0
NOTE  ELECTRICITY AND/OR FUEL USED TO GENERATE ELECTRICITY IS APPORTIONED BASED
      ON THE YEARLY DEMAND.  ALL OTHER ENERGY TYPES ARE APPORTIONED HOURLY.
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BUILDING 602
ANNUAL ENERGY SAVINGS SUMMARY

Item	Baseline	ECO	Annual Energy Savings	Adj. Annual Energy Savings*
Annual Electric (MBTU)	1270.02	773.16	496.86	571.81
Annual Natural Gas (MBTU)	608.64	702.31	-93.67	-107.80
Electric Demand June (KW)	105.22	84.17	21.05	24.22
Electric Demand July (KW)	107.29	86.63	20.66	23.78
Electric Demand August (KW)	109.05	89.04	20.01	23.03

*Energy savings prorated on a square foot basis:

Baseline Model Bldg 7665 (sq.ft.)	9645
ECO Model Bldg 602 (sq.ft.)	11100
Square Footage Adjustment Factor	1.151

LIFE CYCLE COST ANALYSIS SUMMARY
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

LOCATION:	Fort Riley	REGION: 2 (Kansas)		PROJECT NO:	1406-005
PROJECT TITLE:	Feasibility Study for HVAC Upgrade			FISCAL YEAR:	1995
ANALYSIS DATE:	05/08/95	ECONOMIC LIFE:	20	PREPARED BY:	C. Wohlert

1. INVESTMENT: **BLDG 602 - Convert DD AHUs to DDs with VAV Units**

A.	CONSTRUCTION COST	=	$31,697	
B.	SIOH COST	(5.5% of 1A) =	$1,743	
C.	DESIGN COST	(6.0% of 1A) =	$1,902	
D.	TOTAL COST	(1A +1B +1C) =	$35,342	
E.	SALVAGE VALUE OF EXISTING EQUIPMENT =		$0	
F.	PUBLIC UTILITY COMPANY REBATE =		$0	
G.	TOTAL INVESTMENT	(1D -1E -1F) =	------->	$35,342

2. ENERGY SAVINGS (+) OR COST (-):

DATE OF NISTR 85-3273-9 USED FOR DISCOUNT FACTORS: JAN '95

	ENERGY SOURCE	FUEL COST $/MBTU (1)	SAVINGS MBTU/YR (2)	ANNUAL $ SAVINGS (3)	DISCOUNT FACTOR (4)	DISCOUNTED SAVINGS (5)	
A.	ELECT.	$12.10	681	$8,237	15.88	$130,809	
B.	DIST	$0.00	0	$0	19.16	$0	
C.	NAT GAS	$4.12	(132)	($546)	18.30	($9,984)	
D.	COAL	$0.00	0	$0	16.62	$0	
E.	ELEC. DEMAND			$1,242	14.88	$18,480	
F.	TOTAL		548	$8,934		-------->	$139,305

3. NON-ENERGY SAVINGS (+) OR COST (-)

A. ANNUAL RECURRING (+/-)

1 ANNUAL MAINTENANCE	$0	14.88	$0
2	$0	14.88	$0
3	$0	14.88	$0
4 TOTAL ANNUAL DISC. SAVINGS (+) / COST (	$0		$0

B. NON-RECURRING (+/-)

ITEM	SAVINGS (+) COST(-) (1)	YEAR OF OCCURRENCE (2)	DISCOUNT FACTOR (3) (TABLE A-2)	DISCOUNTED SAVINGS/COST (4)
a. BASELINE EQUIP. REPLCMNT.	$0	5	0.863	$0
b.				$0
c.				$0
d.				$0
e.				$0
f. TOTAL	$0			$0

C. TOTAL NON-ENERGY DISCOUNTED SAVINGS (+) OR COST (-) (3A4 + 3Bf4) = $0

4.	FIRST YEAR DOLLAR SAVINGS (+) / COSTS (-)	(2F3+3A4+(3Bf1/Economic Life))	$8,934
5.	SIMPLE PAYBACK (SPB) IN YEARS (MUST BE < 10 YEARS TO QUALIFY)	(1G/4) =	3.96
6.	TOTAL NET DISCOUNTED SAVINGS	(2F5 + 3C) =	$139,305
7.	DISCOUNTED SAVINGS-TO-INVESTMENT RATIO (SIR) (MUST HAVE SIR > 1.25 TO QUALIFY)	(6/1G) =	3.94

ENGINEER'S OPINION OF PROBABLE COST

PROJECT	Fort Riley Feasibility Study for HVAC Upgrade	**SHEET** 1 **OF** 1	
ENGINEER	E M C Engineers, Inc.	**DATE PREPARED**	8-May-95
	Denver, CO	**ESTIMATOR**	C. Wohlert
		CHECKED BY	A. Niemeyer

Line No.	Item Refer Code	Item Description	Unit of Measure	MATERIAL COST Quantity	MATERIAL COST Unit Cost	MATERIAL COST Total	LABOR COST Crew/ Worker	LABOR COST Hours/ Unit	LABOR COST Total	TOTAL
1		**BUILDING 602**								
2		**PROPOSED SYSTEM MODIFICATIONS**								
3										
4	VSD25	VARIABLE SPEED DRIVE W/ CONTRLER,25HP	EA.	1	$5,426.40	$5,426	1-ELEC	25	$523	$5,950
5	E-TSTAT1	SINGLE SETPOINT ELEC. TSTAT, 3 WIRE	EA.	44	$24.23	$1,066	1-ELEC	0.8	$737	$1,803
6	WIRE#12	COPPER WIRING #12	C.L.F.	9	$7.41	$67	1-ELEC	0.727	$137	$204
7	VAVBX5	VAV BOX, 500 CFM, ELEC	EA.	37	$327.00	$12,099	1-SHEE	1.48	$1,140	$13,239
8	VAVBX8	VAV BOX, 800 CFM, ELEC	EA.	5	$331.40	$1,657	1-SHEE	1.5	$156	$1,813
9	VAVBX12	VAV BOX, 1200 CFM, ELEC	EA.	1	$334.30	$334	1-SHEE	1.7	$35	$370
10	VAVBX20	VAV BOX, 2000 CFM, ELEC	EA.	1	$345.90	$346	1-SHEE	1.83	$38	$384
11										
12										
13										
14										
15										
16										
17										
18										
19										
20										
21										
22										
23										
24										
25		*EXISTING SYSTEMS DEMOLITION*								
26		DUAL DUCT MIXING BOX DEMO	EA.	44.0			1-SHEE	3	$2,747	$2,747
27										
28										
29										
30										
31		**SUBTOTAL**				$15,569			$4,990	$20,559
32	OH	OVERHEAD			17%	$2,616			$838	$3,454
33	PRO	PROFIT			10%	$1,818			$583	$2,401
34	CONT	CONTINGENCY			20%	$4,001			$1,282	$5,283
35	**TOTAL COST**		-	-	-	$24,003	-	-	$7,694	$31,697

ENGINEER'S OPINION OF PROBABLE COST

PROJECT	Fort Riley Feasibility Study for HVAC Upgrade	**SHEET** 1	**OF** 1
ENGINEER	E M C Engineers, Inc.	**DATE PREPARED**	1-Mar-95
	Denver, CO	**ESTIMATOR**	C. Wohlert
		CHECKED BY	A. Niemeyer

Line No.	Item Refer Code	Item Description	Unit of Measure	MATERIAL COST Quantity	MATERIAL COST Unit Cost	MATERIAL COST Total	LABOR COST Crew/ Worker	LABOR COST Hours/ Unit	LABOR COST Total	TOTAL
1		**BUILDING 602**								
2		**NON-RECURRING**								
3										
4										
5										
6										
7										
8										
9										
10										
11										
12										
13										
14										
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20										
21										
22										
23										
24										
25										
26										
27										
28										
29										
30										
31		**SUBTOTAL**				$0			$0	$0
32	OH	OVERHEAD			17%	$0			$0	$0
33	PRO	PROFIT			10%	$0			$0	$0
34	CONT	CONTINGENCY			20%	$0			$0	$0
35	**TOTAL COST**		-	-	-	$0	-	-	$0	$0

ENGINEER'S OPINION OF PROBABLE COST

PROJECT	Fort Riley Feasibility Study for HVAC Upgrade	SHEET 1 OF 1	
		DATE PREPARED	1-Mar-95
ENGINEER	E M C Engineers, Inc.	ESTIMATOR	C. Wohlert
	Denver, CO	CHECKED BY	A. Niemeyer

Line No.	Item Refer Code	Item Description	Unit of Measure	MATERIAL COST Quantity	MATERIAL COST Unit Cost	MATERIAL COST Total	LABOR COST Crew/ Worker	LABOR COST Hours/ Unit	LABOR COST Total	TOTAL
1		**BUILDING 602**								
2		***ANNUAL RECURRING***								
3		***ANNUAL MAINTENANCE COST - BASELINE***								
4										
5										
6										
7										
8										
9										
10										
11										
12										
13										
14										
15	**TOTAL ANNUAL MAINTENANCE COST - BASELINE**		-	-	-	$0	-	-	$0	$0
16										
17		***ANNUAL MAINTENANCE COST - NEW HVAC REPLACEMENT***								
18										
19										
20										
21										
22										
23										
24										
25										
26										
27										
28										
29	**TOTAL ANNUAL MAINTENANCE COST - BASELINE**		-	-	-	$0	-	-	$0	$0
30										
31										
32										
33										
34										
35	**TOTAL ANNUAL MAINTENANCE COST SAVINGS**		-	-	-	$0	-	-	$0	$0

DEMAND LIMITING ANALYSIS BUILDING 602

SUMMER PEAK (KW) = 27812	1993 JUL BILL 7/1-8/2 ACTUAL	1993 AUG BILL 8/2-9/1 ACTUAL	1993 SEP BILL 9/3-10/1 ACTUAL	1993 OCT BILL 10/1-11/1 ACTUAL	1993 NOV BILL 11/1-12/1 ACTUAL	1993 DEC BILL 12/1-1/3 ACTUAL	1993 JAN BILL 1/4-2/1 ACTUAL	1993 FEB BILL 2/1-3/1 ACTUAL	1993 MAR BILL 3/3-4/1 ACTUAL	1993 APR BILL 4/1-5/3 ACTUAL	1993 MAY BILL 5/3-6/1 ACTUAL	1993 JUN BILL 6/1-7/1 ACTUAL
BASE CASE												
CAPACITY (KW)	32472	34452	26136	20754	26400	22752	27108	25812	23310	21834	21996	30096
POWER FACTOR (%)	99.20%	99.10%	99.10%	99.90%	99.80%	99.70%	99.50%	99.60%	99.60%	99.80%	99.60%	98.80%
CAPACITY (KVA)	32734	34765	26373	20775	26453	22820	27244	25916	23404	21878	22084	30462
80% SUMMER PEAK (KVA)	27812	27812	27812	27812	27812	27812	27812	27812	27812	27812	27812	27812
CONTRACT MINIMUM (KVA)	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643
BILLING CAPACITY (KVA)	32734	34765	27812	27812	27812	27812	27812	27812	27812	27812	27812	30462
ACTUAL OR 80% PEAK	ACTUAL	ACTUAL	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	ACTUAL
200 KVA @ $4.45	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00
NEXT 400 @ $4.25	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00
REMAINING @ $4.05	$130,142.18	$138,367.78	$110,208.22	$110,208.22	$110,208.22	$110,208.22	$110,208.22	$110,208.22	$110,208.22	$110,208.22	$110,208.22	$120,939.23
SUB DISCOUNT $.20	($6,546.77)	($6,952.98)	($5,562.38)	($5,562.38)	($5,562.38)	($5,562.38)	($5,562.38)	($5,562.38)	($5,562.38)	($5,562.38)	($5,562.38)	($6,092.31)
CAPACITY CHARGE	$126,185.40	$134,004.80	$107,235.84	$107,235.84	$107,235.84	$107,235.84	$107,235.84	$107,235.84	$107,235.84	$107,235.84	$107,235.84	$117,436.92
TOTAL ENERGY (KWH)	16,920,000	16,200,000	10,980,000	10,140,000	11,160,000	12,930,000	12,600,000	12,270,000	12,480,000	11,070,000	9,720,000	13,170,000
50*KVA @ $.03924	$64,223.85	$68,208.70	$54,566.96	$54,566.96	$54,566.96	$54,566.96	$54,566.96	$54,566.96	$54,566.96	$54,566.96	$54,566.96	$59,765.54
100*KVA @ $.03404	$111,426.10	$118,339.66	$94,671.73	$94,671.73	$94,671.73	$94,671.73	$94,671.73	$94,671.73	$94,671.73	$94,671.73	$94,671.73	$103,691.08
250*KVA @ $.03084	$252,378.15	$268,037.26	$209,965.32	$184,059.72	$214,429.80	$214,429.80	$214,429.80	$214,429.80	$214,429.80	$212,740.92	$171,106.92	$234,858.46
EXCESS @ $.02864	$109,589.57	$65,701.49	$0.00	$0.00	$1,009.19	$51,701.99	$42,250.79	$32,799.59	$38,813.99	$0.00	$0.00	$28,221.42
ENERGY CHARGE	$537,617.67	$520,287.11	$359,204.01	$333,298.41	$364,677.69	$415,370.49	$405,919.29	$396,468.09	$402,482.49	$361,979.61	$320,345.61	$426,536.49
TOTAL CHARGE LESS ECA	$663,803.07	$654,291.92	$466,439.85	$440,534.25	$471,913.53	$522,606.33	$513,155.13	$503,703.93	$509,718.33	$469,215.45	$427,581.45	$543,973.42
DEMAND REDUCTION (KW)	**23.78**	**23.03**	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**24.22**
CAPACITY (KW)	32448	34429	26136	20754	26400	22752	27108	25812	23310	21834	21996	30072
POWER FACTOR (%)	99.20%	99.10%	99.10%	99.90%	99.80%	99.70%	99.50%	99.60%	99.60%	99.80%	99.60%	98.80%
CAPACITY (KVA)	32710	34742	26373	20775	26453	22820	27244	25916	23404	21878	22084	30437
80% SUMMER PEAK (KVA)	27793	27793	27793	27793	27793	27793	27793	27793	27793	27793	27793	27793
CONTRACT MINIMUM (KVA)	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643
BILLING CAPACITY (KVA)	32710	34742	27793	27793	27793	27793	27793	27793	27793	27793	27793	30437
ACTUAL OR 80% PEAK	ACTUAL	ACTUAL	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	ACTUAL
200 KVA @ $4.45	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00
NEXT 400 @ $4.25	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00
REMAINING @ $4.05	$130,045.11	$138,273.68	$110,132.94	$110,132.94	$110,132.94	$110,132.94	$110,132.94	$110,132.94	$110,132.94	$110,132.94	$110,132.94	$120,839.93
SUB DISCOUNT $.20	($6,541.98)	($6,948.33)	($5,558.66)	($5,558.66)	($5,558.66)	($5,558.66)	($5,558.66)	($5,558.66)	($5,558.66)	($5,558.66)	($5,558.66)	($6,087.40)
CAPACITY CHARGE	$126,093.13	$133,915.35	$107,164.28	$107,164.28	$107,164.28	$107,164.28	$107,164.28	$107,164.28	$107,164.28	$107,164.28	$107,164.28	$117,342.52
TOTAL ENERGY (KWH)	16,920,000	16,200,000	10,980,000	10,140,000	11,160,000	12,930,000	12,600,000	12,270,000	12,480,000	11,070,000	9,720,000	13,170,000
50*KVA @ $.03924	$64,176.83	$68,163.12	$54,530.49	$54,530.49	$54,530.49	$54,530.49	$54,530.49	$54,530.49	$54,530.49	$54,530.49	$54,530.49	$59,717.43
100*KVA @ $.03404	$111,344.51	$118,260.57	$94,608.46	$94,608.46	$94,608.46	$94,608.46	$94,608.46	$94,608.46	$94,608.46	$94,608.46	$94,608.46	$103,607.61
250*KVA @ $.03084	$252,193.35	$267,858.12	$210,051.30	$184,145.70	$214,286.49	$214,286.49	$214,286.49	$214,286.49	$214,286.49	$212,826.90	$171,192.90	$234,669.42
EXCESS @ $.02864	$109,864.15	$65,967.67	$0.00	$0.00	$1,222.13	$51,914.93	$42,463.73	$33,012.53	$39,026.93	$0.00	$0.00	$28,502.31
ENERGY CHARGE	$537,578.84	$520,249.47	$359,190.26	$333,284.66	$364,647.58	$415,340.38	$405,889.18	$396,437.98	$402,452.38	$361,965.86	$320,331.86	$426,496.77
TOTAL CHARGE LESS ECA	$663,671.97	$654,164.82	$466,354.54	$440,448.94	$471,811.86	$522,504.66	$513,053.46	$503,602.26	$509,616.66	$469,130.14	$427,496.14	$543,839.30
SUMMARY												
MONTHLY DIFFERENCE	$131.11	$127.09	$85.32	$85.32	$101.67	$101.67	$101.67	$101.67	$101.67	$85.32	$85.32	$134.12
ANNUAL DIFFERENCE.............		**$1,241.96**										

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EMC      ENGINEERS     INC.      EZDOE - ELITE SOFTWARE DEVELOPMENT INC      DOE-2.1D   3/16/1995     8:30:20  LDL RUN 1
DENVER,      CO       80227      EXISTING CONDITION OF BLDG. 602        DENTAL CLINIC
REPORT- LV-D  DETAILS OF EXTERIOR SURFACES IN THE PROJECT                     TOPEKA, KS
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NUMBER OF EXTERIOR SURFACES 14 RECTANGULAR 14 OTHER 0
(U-VALUE INCLUDES INSIDE AIR FILM PLUS OUTSIDE AIR FILM AT 7.5 MPH WINDSPEED)

SURFACE	SPACE	- - - - G L A S S - - - - U-VALUE (BTU/HR-SQFT-F)	AREA (SQFT)	- - - - W A L L - - - - U-VALUE (BTU/HR-SQFT-F)	AREA (SQFT)	- W A L L + G L A S S - U-VALUE (BTU/HR-SQFT-F)	AREA (SQFT)	AZIMUTH
	SPACE_3	0.490	39.60	0.209	420.40	0.233	460.00	NORTH
	PLENUM_6	0.000	0.00	0.209	172.50	0.209	172.50	NORTH
	PLENUM_6	0.000	0.00	0.209	504.00	0.209	504.00	EAST
	SPACE_2	0.490	198.00	0.209	1146.00	0.251	1344.00	EAST
	PLENUM_6	0.000	0.00	0.209	172.50	0.209	172.50	SOUTH
	SPACE_4	0.490	78.00	0.209	382.00	0.257	460.00	SOUTH
	PLENUM_6	0.000	0.00	0.209	504.00	0.209	504.00	WEST
	SPACE_1	0.490	312.00	0.209	1032.00	0.274	1344.00	WEST
	SPACE_5	0.000	0.00	0.087	3795.00	0.087	3795.00	ROOF
	SPACE_1	0.000	0.00	0.087	2295.00	0.087	2295.00	ROOF
	SPACE_3	0.000	0.00	0.087	637.50	0.087	637.50	ROOF
	SPACE_2	0.000	0.00	0.087	2295.00	0.087	2295.00	ROOF
	SPACE_4	0.000	0.00	0.087	637.50	0.087	637.50	ROOF
	PLENUM_6	0.000	0.00	0.087	9660.00	0.087	9660.00	ROOF
	SPACE_1	0.000	0.00	0.020	2295.00	0.020	2295.00	UNDERGRND
	SPACE_2	0.000	0.00	0.020	2295.00	0.020	2295.00	UNDERGRND
	SPACE_3	0.000	0.00	0.020	637.50	0.020	637.50	UNDERGRND
	SPACE_4	0.000	0.00	0.020	637.50	0.020	637.50	UNDERGRND
	SPACE_5	0.000	0.00	0.020	3795.00	0.020	3795.00	UNDERGRND


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EMC      ENGINEERS     INC.      EZDOE - ELITE SOFTWARE DEVELOPMENT INC      DOE-2.1D   3/16/1995     8:30:20  LDL RUN 1
DENVER,      CO       80227      EXISTING CONDITION OF BLDG. 602        DENTAL CLINIC
REPORT- LV-D  DETAILS OF EXTERIOR SURFACES IN THE PROJECT                     TOPEKA, KS
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	AVERAGE U-VALUE/GLASS (BTU/HR-SQFT-F)	AVERAGE U-VALUE/WALLS (BTU/HR-SQFT-F)	AVERAGE U-VALUE WALLS+GLASS (BTU/HR-SQFT-F)	GLASS AREA (SQFT)	OPAQUE AREA (SQFT)	GLASS+OPAQUE AREA (SQFT)
NORTH	0.490	0.209	0.227	39.60	592.90	632.50
EAST	0.490	0.209	0.239	198.00	1650.00	1848.00
SOUTH	0.490	0.209	0.244	78.00	554.50	632.50
WEST	0.490	0.209	0.257	312.00	1536.00	1848.00
ROOF	0.000	0.087	0.087	0.00	19320.00	19320.00
ALL WALLS	0.490	0.209	0.245	627.60	4333.40	4961.00
WALLS+ROOFS	0.490	0.109	0.119	627.60	23653.40	24281.00
UNDERGRND	0.000	0.020	0.020	0.00	9660.00	9660.00
BUILDING	0.490	0.083	0.091	627.60	33313.40	33941.00

EMC ENGINEERS INC. EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 3/16/1995 8:30:20 LDL RUN 1
DENVER, CO 80227 EXISTING CONDITION OF BLDG. 602 DENTAL CLINIC
REPORT- LS-C BUILDING PEAK LOAD COMPONENTS TOPEKA, KS

*** BUILDING ***

FLOOR AREA	9645	SQFT	896	SQMT
VOLUME	106268	CUFT	3010	CUMT

	COOLING LOAD				HEATING LOAD	
TIME	AUG 11	4PM			JAN 15	8AM
DRY-BULB TEMP	100F	38C			-6F	-21C
WET-BULB TEMP	71F	22C			-7F	-22C
	SENSIBLE		LATENT		SENSIBLE	
	(KBTU/H)	(KW)	(KBTU/H)	(KW)	(KBTU/H)	(KW)
WALLS	8.794	2.576	0.000	0.000	-46.897	-13.735
ROOFS	44.911	13.153	0.000	0.000	-71.534	-20.950
GLASS CONDUCTION	7.254	2.124	0.000	0.000	-24.039	-7.040
GLASS SOLAR	23.372	6.845	0.000	0.000	0.990	0.290
DOOR	0.000	0.000	0.000	0.000	0.000	0.000
INTERNAL SURFACES	0.000	0.000	0.000	0.000	0.000	0.000
UNDERGROUND SURFACES	-0.914	-0.268	0.000	0.000	-5.547	-1.625
OCCUPANTS TO SPACE	7.862	2.303	14.353	4.204	0.285	0.083
LIGHT TO SPACE	107.528	31.492	0.000	0.000	6.010	1.760
EQUIPMENT TO SPACE	31.414	9.200	0.000	0.000	1.138	0.333
PROCESS TO SPACE	0.000	0.000	0.000	0.000	0.000	0.000
INFILTRATION	0.000	0.000	0.000	0.000	0.000	0.000
TOTAL	230.221	67.426	14.353	4.204	-139.593	-40.883
TOTAL LOAD	244.573 KBTU/H		71.629 KW		-139.593 KBTU/H	-40.883 KW
TOTAL LOAD / AREA	25.36BTU/H.SQFT		79.939 W /SQMT		14.473BTU/H.SQFT	45.626 W /SQMT

NOTE
1) THE ABOVE LOADS EXCLUDE OUTSIDE VENTILATION AIR LOADS
2) TIMES GIVEN IN STANDARD TIME FOR THE LOCATION IN CONSIDERATION

EMC ENGINEERS INC. EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 3/16/1995 8:30:20 SDL RUN 1
DENVER, CO 80227 EXISTING CONDITION OF BLDG. 602 DENTAL CLINIC
REPORT- SS-A SYSTEM MONTHLY LOADS SUMMARY FOR DUAL_DUCT TOPEKA, KS

MONTH	COOLING ENERGY (MBTU)	COOLING TIME OF MAX DY	COOLING TIME OF MAX HR	COOLING DRY-BULB TEMP	COOLING WET-BULB TEMP	MAXIMUM COOLING LOAD (KBTU/HR)	HEATING ENERGY (MBTU)	HEATING TIME OF MAX DY	HEATING TIME OF MAX HR	HEATING DRY-BULB TEMP	HEATING WET-BULB TEMP	MAXIMUM HEATING LOAD (KBTU/HR)	ELEC-TRICAL ENERGY (KWH)	MAXIMUM ELEC LOAD (KW)
JAN	0.00000					0.000	-57.426	15	8	-6.F	-7.F	-218.388	25516.	67.457
FEB	0.00000					0.000	-39.102	3	6	-1.F	-2.F	-179.002	23062.	67.457
MAR	0.00000					0.000	-44.015	6	7	19.F	18.F	-136.201	26440.	67.457
APR	0.00000					0.000	-56.338	22	18	67.F	52.F	-165.788	25006.	67.457
MAY	60.03765	16	2	62.F	59.F	563.950	-33.741	13	18	80.F	66.F	-182.360	25516.	67.457
JUN	125.61597	28	16	90.F	76.F	356.360	0.000					0.000	25468.	67.457
JUL	142.58212	13	16	93.F	77.F	368.605	0.000					0.000	25054.	67.457
AUG	144.29832	23	16	96.F	77.F	367.669	0.000					0.000	26440.	67.457
SEP	100.69760	7	16	93.F	76.F	354.710	0.000					0.000	25006.	67.457
OCT	1.60873	1	18	83.F	68.F	131.074	-51.112	6	18	67.F	52.F	-157.027	25054.	67.457
NOV	0.00000					0.000	-38.996	23	18	63.F	52.F	-129.139	24544.	67.457
DEC	0.00000					0.000	-47.896	12	6	3.F	2.F	-185.054	25516.	67.457
TOTAL	574.841						-368.626						302611.	
MAX						563.950						-218.388		67.457

D6-9

EMC ENGINEERS INC. EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 3/16/1995 8:30:20 SDL RUN 1
DENVER, CO 80227 EXISTING CONDITION OF BLDG. 602 DENTAL CLINIC
REPORT- SS-C SYSTEM MONTHLY LOAD HOURS FOR DUAL_DUCT TOPEKA, KS

MONTH	HOURS COOLING LOAD	HOURS HEATING LOAD	HOURS COINCIDENT COOL-HEAT LOAD	HOURS FLOATING	HOURS HEATING AVAIL.	HOURS COOLING AVAIL.	HOURS FANS ON	HOURS FANS CYCLE ON	HOURS NIGHT VENTING	HOURS FLOATING WHEN FANS ON	COINCIDENT LOADS: HEATING LOAD AT COOLING PEAK (KBTU/HR)	COINCIDENT LOADS: ELECTRIC LOAD AT COOLING PEAK (KW)
JAN	0	744	0	0	744	0	744	0	0	0	-53.279	21.255
FEB	0	672	0	0	672	0	672	0	0	0	-47.569	21.255
MAR	0	744	0	0	744	0	744	0	0	0	-59.268	21.255
APR	0	720	0	0	720	0	720	0	0	0	-93.275	21.255
MAY	384	360	0	0	360	384	744	0	0	0	0.000	21.255
JUN	720	0	0	0	0	720	720	0	0	0	0.000	67.457
JUL	744	0	0	0	0	744	744	0	0	0	0.000	67.457
AUG	744	0	0	0	0	744	744	0	0	0	0.000	67.457
SEP	720	0	0	0	0	720	720	0	0	0	0.000	67.457
OCT	24	720	0	0	720	24	744	0	0	0	0.000	21.255
NOV	0	720	0	0	720	0	720	0	0	0	-58.184	21.255
DEC	0	744	0	0	744	0	744	0	0	0	-111.254	21.255
ANNUAL	3336	5424	0	0	5424	3336	8760	0	0	0		

MO	UTILITY-	ELECTRICITY	NATURAL-GAS
	TOTAL(MBTU)	90.363	91.393
JAN	PEAK(KBTU)	235.181	293.361
	DY/HR	28/10	15/ 8
	TOTAL(MBTU)	81.563	66.359
FEB	PEAK(KBTU)	235.181	248.719
	DY/HR	25/16	3/ 6
	TOTAL(MBTU)	93.633	75.746
MAR	PEAK(KBTU)	235.181	198.523
	DY/HR	31/16	6/ 7
	TOTAL(MBTU)	88.817	91.527
APR	PEAK(KBTU)	235.181	233.409
	DY/HR	29/16	22/18
	TOTAL(MBTU)	110.498	52.689
MAY	PEAK(KBTU)	354.062	252.582
	DY/HR	16/15	13/18
	TOTAL(MBTU)	132.744	0.000
JUN	PEAK(KBTU)	359.126	0.000
	DY/HR	28/16	30/ 1
	TOTAL(MBTU)	137.623	0.000
JUL	PEAK(KBTU)	366.189	0.000
	DY/HR	22/16	31/ 1
	TOTAL(MBTU)	144.414	0.000
AUG	PEAK(KBTU)	372.178	0.000
	DY/HR	11/16	31/ 1
	TOTAL(MBTU)	123.696	0.000
SEP	PEAK(KBTU)	362.746	0.000
	DY/HR	7/16	30/ 1
	TOTAL(MBTU)	89.603	84.105
OCT	PEAK(KBTU)	235.181	223.166
	DY/HR	31/16	6/18
	TOTAL(MBTU)	86.815	67.485
NOV	PEAK(KBTU)	235.181	190.072
	DY/HR	30/16	23/18
	TOTAL(MBTU)	90.285	79.335
DEC	PEAK(KBTU)	235.181	255.675
	DY/HR	23/16	12/ 6
	ONE YEAR	1270.055	608.638
	USE/PEAK	372.178	293.361

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EMC       ENGINEERS       INC.      EZDOE - ELITE SOFTWARE DEVELOPMENT INC        DOE-2.1D   3/16/1995      8:30:20  PDL RUN 1
   DENVER,       CO       80227     EXISTING CONDITION OF BLDG. 602          DENTAL CLINIC
REPORT- BEPS  ESTIMATED BUILDING ENERGY PERFORMANCE                                TOPEKA, KS
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ENERGY TYPE IN SITE MBTU - CATEGORY OF USE	ELECTRICITY	NATURAL-GAS
SPACE HEAT	24.03	608.64
SPACE COOL	187.62	0.00
HVAC AUX	660.84	0.00
DOM HOT WTR	0.00	0.00
AUX SOLAR	0.00	0.00
LIGHTS	310.83	0.00
VERT TRANS	0.00	0.00
MISC EQUIP	86.71	0.00
TOTAL	1270.02	608.64

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TOTAL SITE ENERGY      1878.69 MBTU    194.5 KBTU/SQFT-YR GROSS-AREA     194.8 KBTU/SQFT-YR NET-AREA
TOTAL SOURCE ENERGY    4422.62 MBTU    457.8 KBTU/SQFT-YR GROSS-AREA     458.5 KBTU/SQFT-YR NET-AREA
PERCENT OF HOURS ANY SYSTEM ZONE OUTSIDE OF THROTTLING RANGE =  0.0
PERCENT OF HOURS ANY PLANT LOAD NOT SATISFIED                =  0.0
NOTE  ELECTRICITY AND/OR FUEL USED TO GENERATE ELECTRICITY IS APPORTIONED BASED
      ON THE YEARLY DEMAND.  ALL OTHER ENERGY TYPES ARE APPORTIONED HOURLY.
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EMC ENGINEERS INC. EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 3/16/1995 8:33:21 SDL RUN 1
DENVER, CO 80227 PROPOSED MODIFICATION OF BLDG. 602 DENTAL CLINIC
REPORT- SS-A SYSTEM MONTHLY LOADS SUMMARY FOR DUAL_DUCT TOPEKA, KS

MONTH	COOLING ENERGY (MBTU)	COOLING TIME OF MAX DY	COOLING TIME OF MAX HR	COOLING DRY-BULB TEMP	COOLING WET-BULB TEMP	MAXIMUM COOLING LOAD (KBTU/HR)	HEATING ENERGY (MBTU)	HEATING TIME OF MAX DY	HEATING TIME OF MAX HR	HEATING DRY-BULB TEMP	HEATING WET-BULB TEMP	MAXIMUM HEATING LOAD (KBTU/HR)	ELEC- TRICAL ENERGY (KWH)	MAXIMUM ELEC LOAD (KW)
JAN	0.00000					0.000	-99.970	15	7	-7.F	-8.F	-294.778	11324.	67.436
FEB	0.00000					0.000	-74.409	3	6	-1.F	-2.F	-261.983	10440.	67.436
MAR	0.00000					0.000	-59.934	14	6	15.F	13.F	-221.552	14416.	67.436
APR	0.00000					0.000	-32.239	4	6	32.F	31.F	-142.807	15928.	67.436
MAY	29.15188	16	16	80.F	68.F	281.222	-14.285	13	1	69.F	64.F	-98.890	15078.	67.436
JUN	71.47971	28	16	90.F	76.F	306.793	0.000					0.000	12730.	67.436
JUL	85.68158	13	16	93.F	77.F	321.658	0.000					0.000	11370.	67.436
AUG	89.44794	23	16	96.F	77.F	320.574	0.000					0.000	13033.	67.436
SEP	48.54211	7	16	93.F	76.F	305.178	0.000					0.000	12106.	67.436
OCT	0.10436	1	18	83.F	68.F	27.479	-25.425	31	6	44.F	39.F	-117.493	15731.	67.436
NOV	0.00000					0.000	-52.250	3	6	13.F	12.F	-205.326	13236.	67.436
DEC	0.00000					0.000	-89.954	12	6	3.F	2.F	-258.103	11301.	67.292
TOTAL	324.408						-448.465						156697.	
MAX						321.658						-294.778		67.436

D6-12

EMC ENGINEERS INC. EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 3/16/1995 8:33:21 SDL RUN 1
DENVER, CO 80227 PROPOSED MODIFICATION OF BLDG. 602 DENTAL CLINIC
REPORT- SS-C SYSTEM MONTHLY LOAD HOURS FOR DUAL_DUCT TOPEKA, KS

MONTH	HOURS COOLING LOAD	HOURS HEATING LOAD	HOURS COINCIDENT COOL-HEAT LOAD	HOURS FLOATING	HOURS HEATING AVAIL.	HOURS COOLING AVAIL.	HOURS FANS ON	HOURS FANS CYCLE ON	HOURS NIGHT VENTING	HOURS FLOATING WHEN FANS ON	COINCIDENT LOADS: HEATING LOAD AT COOLING PEAK (KBTU/HR)	COINCIDENT LOADS: ELECTRIC LOAD AT COOLING PEAK (KW)
JAN	0	744	0	0	744	0	744	0	0	0	-119.820	0.978
FEB	0	672	0	0	672	0	672	0	0	0	-109.444	0.978
MAR	0	744	0	0	744	0	744	0	0	0	-100.393	0.978
APR	0	720	0	0	720	0	720	0	0	0	-61.483	3.962
MAY	291	360	0	93	360	384	744	0	0	93	0.000	54.735
JUN	626	0	0	94	0	720	720	0	0	94	0.000	54.158
JUL	715	0	0	29	0	744	744	0	0	29	0.000	54.824
AUG	705	0	0	39	0	744	744	0	0	39	0.000	54.776
SEP	483	0	0	237	0	720	720	0	0	237	0.000	54.155
OCT	8	720	0	16	720	24	744	0	0	16	0.000	0.978
NOV	0	720	0	0	720	0	720	0	0	0	-147.855	0.978
DEC	0	744	0	0	744	0	744	0	0	0	-183.170	0.978
ANNUAL	2828	5424	0	508	5424	3336	8760	0	0	508		

EMC ENGINEERS INC. EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 3/16/1995 8:33:21 PDL RUN 1
DENVER, CO 80227 PROPOSED MODIFICATION OF BLDG. 602 DENTAL CLINIC
REPORT- PS-B MONTHLY PEAK AND TOTAL ENERGY USE TOPEKA, KS

MO	UTILITY-	ELECTRICITY	NATURAL-GAS
	TOTAL(MBTU)	43.076	151.156
JAN	PEAK(KBTU)	233.308	395.976
	DY/HR	24/15	15/ 7
	TOTAL(MBTU)	39.446	116.271
FEB	PEAK(KBTU)	233.258	359.041
	DY/HR	14/16	3/ 6
	TOTAL(MBTU)	52.940	98.163
MAR	PEAK(KBTU)	233.854	312.458
	DY/HR	31/15	14/ 6
	TOTAL(MBTU)	57.215	58.697
APR	PEAK(KBTU)	232.490	218.401
	DY/HR	22/ 8	4/ 6
	TOTAL(MBTU)	63.175	26.467
MAY	PEAK(KBTU)	275.480	164.036
	DY/HR	31/16	13/ 1
	TOTAL(MBTU)	68.918	0.000
JUN	PEAK(KBTU)	287.284	0.000
	DY/HR	28/16	30/ 1
	TOTAL(MBTU)	69.555	0.000
JUL	PEAK(KBTU)	295.677	0.000
	DY/HR	13/16	31/ 1
	TOTAL(MBTU)	77.397	0.000
AUG	PEAK(KBTU)	303.856	0.000
	DY/HR	11/16	31/ 1
	TOTAL(MBTU)	59.121	0.000
SEP	PEAK(KBTU)	290.162	0.000
	DY/HR	7/16	30/ 1
	TOTAL(MBTU)	56.124	47.272
OCT	PEAK(KBTU)	232.936	187.232
	DY/HR	20/11	31/ 6
	TOTAL(MBTU)	48.594	86.812
NOV	PEAK(KBTU)	233.030	293.436
	DY/HR	1/13	3/ 6
	TOTAL(MBTU)	42.951	138.865
DEC	PEAK(KBTU)	232.694	354.621
	DY/HR	20/15	12/ 6
	ONE YEAR	678.511	723.704
	USE/PEAK	303.856	395.976

ENERGY TYPE IN SITE MBTU - CATEGORY OF USE	ELECTRICITY	NATURAL-GAS
SPACE HEAT	26.14	723.70
SPACE COOL	105.21	0.00
HVAC AUX	149.61	0.00
DOM HOT WTR	0.00	0.00
AUX SOLAR	0.00	0.00
LIGHTS	310.82	0.00
VERT TRANS	0.00	0.00
MISC EQUIP	86.71	0.00
TOTAL	678.49	723.70

TOTAL SITE ENERGY 1402.21 MBTU 145.2 KBTU/SQFT-YR GROSS-AREA 145.4 KBTU/SQFT-YR NET-AREA
TOTAL SOURCE ENERGY 2761.27 MBTU 285.8 KBTU/SQFT-YR GROSS-AREA 286.3 KBTU/SQFT-YR NET-AREA
PERCENT OF HOURS ANY SYSTEM ZONE OUTSIDE OF THROTTLING RANGE = 27.5
PERCENT OF HOURS ANY PLANT LOAD NOT SATISFIED = 0.0
NOTE ELECTRICITY AND/OR FUEL USED TO GENERATE ELECTRICITY IS APPORTIONED BASED ON THE YEARLY DEMAND. ALL OTHER ENERGY TYPES ARE APPORTIONED HOURLY.

BUILDING 7665
ANNUAL ENERGY SAVINGS SUMMARY

Item	Baseline	ECO	Annual Energy Savings	Adj. Annual Energy Savings*
Annual Electric (MBTU)	995.96	695.40	300.56	300.56
Annual Natural Gas (MBTU)	597.83	704.54	-106.71	-106.71
Electric Demand June (KW)	95.98	83.10	12.89	12.89
Electric Demand July (KW)	98.68	86.20	12.48	12.48
Electric Demand August (KW)	100.00	88.28	11.71	11.71

*Energy savings prorated on a square foot basis:

Baseline Model Bldg 7665 (sq.ft.)	9645
ECO Model Bldg 7665 (sq.ft.)	9645
Square Footage Adjustment Factor	1.000

LIFE CYCLE COST ANALYSIS SUMMARY
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

LOCATION:	Fort Riley	REGION: 2 (Kansas)		PROJECT NO:	1406-005
PROJECT TITLE:	Feasibility Study for HVAC Upgrade			FISCAL YEAR:	1995
ANALYSIS DATE:	05/04/95	ECONOMIC LIFE:	20	PREPARED BY:	C. Wohlert

1. INVESTMENT: **BLDG 7665 - Convert Existing MZ to VAV AHUs**

A.	CONSTRUCTION COST	=	$10,951	
B.	SIOH COST	(5.5% of 1A) =	$602	
C.	DESIGN COST	(6.0% of 1A) =	$657	
D.	TOTAL COST	(1A +1B +1C) =	$12,210	
E.	SALVAGE VALUE OF EXISTING EQUIPMENT =		$0	
F.	PUBLIC UTILITY COMPANY REBATE =		$0	
G.	TOTAL INVESTMENT	(1D -1E -1F) =	------->	$12,210

2. ENERGY SAVINGS (+) OR COST (-):
DATE OF NISTR 85-3273-9 USED FOR DISCOUNT FACTORS: JAN '95

	ENERGY SOURCE	FUEL COST $/MBTU (1)	SAVINGS MBTU/YR (2)	ANNUAL $ SAVINGS (3)	DISCOUNT FACTOR (4)	DISCOUNTED SAVINGS (5)	
A.	ELECT.	$12.10	301	$3,637	15.88	$57,752	
B.	DIST	$0.00	0	$0	19.16	$0	
C.	NAT GAS	$4.12	(107)	($440)	18.30	($8,046)	
D.	COAL	$0.00	0	$0	16.62	$0	
E.	ELEC. DEMAND			$637	14.88	$9,479	
F.	TOTAL		194	$3,834		-------->	$59,185

3. NON-ENERGY SAVINGS (+) OR COST (-)
A. ANNUAL RECURRING (+/-)

1 ANNUAL MAINTENANCE	$0	14.88	$0
2	$0	14.88	$0
3	$0	14.88	$0
4 TOTAL ANNUAL DISC. SAVINGS (+) / COST (-	$0		$0

B. NON-RECURRING (+/-)

ITEM	SAVINGS (+) COST(-) (1)	YEAR OF OCCURRENCE (2)	DISCOUNT FACTOR (3) (TABLE A-2)	DISCOUNTED SAVINGS/COST (4)
a. BASELINE EQUIP. REPLCMNT.	$0	5	0.863	$0
b.				$0
c.				$0
d. TOTAL	$0			$0

C. TOTAL NON-ENERGY DISCOUNTED SAVINGS (+) OR COST (-) (3A4 + 3Bd4) = $0

4.	FIRST YEAR DOLLAR SAVINGS (+) / COSTS (-)	(2F3+3A4+(3Bd1/Economic Life))	$3,834
5.	SIMPLE PAYBACK (SPB) IN YEARS (MUST BE < 10 YEARS TO QUALIFY)	(1G/4) =	3.18
6.	TOTAL NET DISCOUNTED SAVINGS	(2F5 + 3C) =	$59,185
7.	DISCOUNTED SAVINGS-TO-INVESTMENT RATIO (SIR) (MUST HAVE SIR > 1.25 TO QUALIFY)	(6/1G) =	4.85

ENGINEER'S OPINION OF PROBABLE COST		SHEET 1 OF 1	
PROJECT	Fort Riley Feasibility Study for HVAC Upgrade	**DATE PREPARED**	4-May-95
ENGINEER	E M C Engineers, Inc. Denver, CO	**ESTIMATOR**	C. Wohlert
		CHECKED BY	A. Niemeyer

Line No.	Item Refer Code	Item Description	Unit of Measure	MATERIAL COST Quantity	MATERIAL COST Unit Cost	MATERIAL COST Total	LABOR COST Crew/ Worker	LABOR COST Hours/ Unit	LABOR COST Total	TOTAL
1		**BUILDING 7665**								
2		**PROPOSED SYSTEM MODIFICATIONS**								
3										
4										
5	VSD15	VARIABLE SPEED DRIVE W/ CONTRLER,15HP	EA.	1.0	$4,060.11	$4,060	1-ELEC	19	$398	$4,458
6	E-TSTAT1	SINGLE SETPOINT ELEC. TSTAT, 3 WIRE	EA.	6.0	$24.23	$145	1-ELEC	0.8	$100	$246
7	WIRE#12	COPPER WIRING #12	C.L.F.	7.0	$7.41	$52	1-ELEC	0.727	$107	$158
8	VAVBX12	VAV BOX, 1200 CFM, ELEC	EA.	2.0	$271.32	$543	1-SHEE	1.13	$47	$590
9	VAVBX24	VAV BOX, 2400 CFM, ELEC	EA.	2.0	$287.31	$575	1-SHEE	1.33	$55	$630
10	VAVBX70	VAV BOX, 7000 CFM, ELEC	EA.	2.0	$353.69	$707	1-SHEE	2.6	$108	$816
11	ELE-SWIT	DDC SWITCH	EA.	1.0	$69.77	$70	1-STPI	0.5	$11	$81
12										
13										
14										
15										
16										
17										
18										
19										
20										
21										
22										
23										
24										
25		*EXISTING SYSTEMS DEMOLITION*								
26		ZONE DUCTWORK DEMOLITION	EA.	6.0			1-SHEE	1	$125	$125
27										
28										
29										
30										
31		**SUBTOTAL**				$6,152			$951	$7,103
32	OH	OVERHEAD			17%	$1,033			$160	$1,193
33	PRO	PROFIT			10%	$719			$111	$830
34	CONT	CONTINGENCY			20%	$1,581			$244	$1,825
35	**TOTAL COST**		-	-	-	$9,485	-	-	$1,466	$10,951

ENGINEER'S OPINION OF PROBABLE COST

PROJECT	Fort Riley Feasibility Study for HVAC Upgrade	**SHEET**	1 **OF** 1
ENGINEER	E M C Engineers, Inc.	**DATE PREPARED**	28-Feb-95
	Denver, CO	**ESTIMATOR**	C. Wohlert
		CHECKED BY	A. Niemeyer

Line No.	Item Refer Code	Item Description	Unit of Measure	MATERIAL COST Quantity	MATERIAL COST Unit Cost	MATERIAL COST Total	LABOR COST Crew/ Worker	LABOR COST Hours/ Unit	LABOR COST Total	TOTAL
1		**BUILDING 7665**								
2		**NON-RECURRING**								
3										
4										
5										
6										
7										
8										
9										
10										
11										
12										
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14										
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21										
22										
23										
24										
25										
26										
27										
28										
29										
30										
31		**SUBTOTAL**				$0			$0	$0
32	OH	OVERHEAD			17%	$0			$0	$0
33	PRO	PROFIT			10%	$0			$0	$0
34	CONT	CONTINGENCY			20%	$0			$0	$0
35	**TOTAL COST**		-	-	-	$0	-	-	$0	$0

ENGINEER'S OPINION OF PROBABLE COST

PROJECT	Fort Riley Feasibility Study for HVAC Upgrade	SHEET 1 OF 1	
ENGINEER	E M C Engineers, Inc. Denver, CO	DATE PREPARED	1-Mar-95
		ESTIMATOR	C. Wohlert
		CHECKED BY	A. Niemeyer

Line No.	Item Refer Code	Item Description	Unit of Measure	MATERIAL COST Quantity	MATERIAL COST Unit Cost	MATERIAL COST Total	LABOR COST Crew/ Worker	LABOR COST Hours/ Unit	LABOR COST Total	TOTAL
1		**BUILDING 7665**								
2		***ANNUAL RECURRING***								
3		***ANNUAL MAINTENANCE COST - BASELINE***								
4										
5										
6										
7										
8										
9										
10										
11										
12										
13										
14										
15	**TOTAL ANNUAL MAINTENANCE COST - BASELINE**		-	-	-	$0	-	-	$0	$0
16										
17		***ANNUAL MAINTENANCE COST - NEW HVAC REPLACEMENT***								
18										
19										
20										
21										
22										
23										
24										
25										
26										
27										
28										
29	**TOTAL ANNUAL MAINTENANCE COST - BASELINE**		-	-	-	$0	-	-	$0	$0
30										
31										
32										
33										
34										
35	**TOTAL ANNUAL MAINTENANCE COST SAVINGS**		-	-	-	$0	-	-	$0	$0

DEMAND LIMITING ANALYSIS BUILDING 7665

	1993	1993	1993	1993	1993	1993	1993	1993	1993	1993	1993	1993
SUMMER PEAK (KW) =	JUL BILL	AUG BILL	SEP BILL	OCT BILL	NOV BILL	DEC BILL	JAN BILL	FEB BILL	MAR BILL	APR BILL	MAY BILL	JUN BILL
27812	7/1-8/2	8/2-9/1	9/3-10/1	10/1-11/1	11/1-12/1	12/1-1/3	1/4-2/1	2/1-3/1	3/3-4/1	4/1-5/3	5/3-6/1	6/1-7/1
	ACTUAL	ACTUAL	ACTUAL	ACTUAL	ACTUAL	ACTUAL	ACTUAL	ACTUAL	ACTUAL	ACTUAL	ACTUAL	ACTUAL
BASE CASE												
CAPACITY (KW)	32472	34452	26136	20754	26400	22752	27108	25812	23310	21834	21996	30096
POWER FACTOR (%)	99.20%	99.10%	99.10%	99.90%	99.80%	99.70%	99.50%	99.60%	99.60%	99.80%	99.60%	98.80%
CAPACITY (KVA)	32734	34765	26373	20775	26453	22820	27244	25916	23404	21878	22084	30462
80% SUMMER PEAK (KVA)	27812	27812	27812	27812	27812	27812	27812	27812	27812	27812	27812	27812
CONTRACT MINIMUM (KVA)	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643
BILLING CAPACITY (KVA)	32734	34765	27812	27812	27812	27812	27812	27812	27812	27812	27812	30462
ACTUAL OR 80% PEAK	ACTUAL	ACTUAL	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	ACTUAL
200 KVA @ $4.45	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00
NEXT 400 @ $4.25	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00
REMAINING @ $4.05	$130,142.18	$138,367.78	$110,208.22	$110,208.22	$110,208.22	$110,208.22	$110,208.22	$110,208.22	$110,208.22	$110,208.22	$110,208.22	$120,939.23
SUB DISCOUNT $.20	($6,546.77)	($6,952.98)	($5,562.38)	($5,562.38)	($5,562.38)	($5,562.38)	($5,562.38)	($5,562.38)	($5,562.38)	($5,562.38)	($5,562.38)	($6,092.31)
CAPACITY CHARGE	$126,185.40	$134,004.80	$107,235.84	$107,235.84	$107,235.84	$107,235.84	$107,235.84	$107,235.84	$107,235.84	$107,235.84	$107,235.84	$117,436.92
TOTAL ENERGY (KWH)	16,920,000	16,200,000	10,980,000	10,140,000	11,160,000	12,930,000	12,600,000	12,270,000	12,480,000	11,070,000	9,720,000	13,170,000
50*KVA @ $.03924	$64,223.85	$68,208.70	$54,566.96	$54,566.96	$54,566.96	$54,566.96	$54,566.96	$54,566.96	$54,566.96	$54,566.96	$54,566.96	$59,765.54
100*KVA @ $.03404	$111,426.10	$118,339.66	$94,671.73	$94,671.73	$94,671.73	$94,671.73	$94,671.73	$94,671.73	$94,671.73	$94,671.73	$94,671.73	$103,691.08
250*KVA @ $.03084	$252,378.15	$268,037.26	$209,965.32	$184,059.72	$214,429.80	$214,429.80	$214,429.80	$214,429.80	$214,429.80	$212,740.92	$171,106.92	$234,858.46
EXCESS @ $.02864	$109,589.57	$65,701.49	$0.00	$0.00	$1,009.19	$51,701.99	$42,250.79	$32,799.59	$38,813.99	$0.00	$0.00	$28,221.42
ENERGY CHARGE	$537,617.67	$520,287.11	$359,204.01	$333,298.41	$364,677.69	$415,370.49	$405,919.29	$396,468.09	$402,482.49	$361,979.61	$320,345.61	$426,536.49
TOTAL CHARGE LESS ECA	$663,803.07	$654,291.92	$466,439.85	$440,534.25	$471,913.53	$522,606.33	$513,155.13	$503,703.93	$509,718.33	$469,215.45	$427,581.45	$543,973.42
DEMAND REDUCTION (KW)	**12.48**	**11.71**	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**12.89**
CAPACITY (KW)	32460	34440	26136	20754	26400	22752	27108	25812	23310	21834	21996	30083
POWER FACTOR (%)	99.20%	99.10%	99.10%	99.90%	99.80%	99.70%	99.50%	99.60%	99.60%	99.80%	99.60%	98.80%
CAPACITY (KVA)	32721	34753	26373	20775	26453	22820	27244	25916	23404	21878	22084	30448
80% SUMMER PEAK (KVA)	27802	27802	27802	27802	27802	27802	27802	27802	27802	27802	27802	27802
CONTRACT MINIMUM (KVA)	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643
BILLING CAPACITY (KVA)	32721	34753	27802	27802	27802	27802	27802	27802	27802	27802	27802	30448
ACTUAL OR 80% PEAK	ACTUAL	ACTUAL	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	ACTUAL
200 KVA @ $4.45	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00
NEXT 400 @ $4.25	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00
REMAINING @ $4.05	$130,091.23	$138,319.91	$110,169.93	$110,169.93	$110,169.93	$110,169.93	$110,169.93	$110,169.93	$110,169.93	$110,169.93	$110,169.93	$120,886.40
SUB DISCOUNT $.20	($6,544.26)	($6,950.61)	($5,560.49)	($5,560.49)	($5,560.49)	($5,560.49)	($5,560.49)	($5,560.49)	($5,560.49)	($5,560.49)	($5,560.49)	($6,089.70)
CAPACITY CHARGE	$126,136.97	$133,959.30	$107,199.44	$107,199.44	$107,199.44	$107,199.44	$107,199.44	$107,199.44	$107,199.44	$107,199.44	$107,199.44	$117,386.70
TOTAL ENERGY (KWH)	16,920,000	16,200,000	10,980,000	10,140,000	11,160,000	12,930,000	12,600,000	12,270,000	12,480,000	11,070,000	9,720,000	13,170,000
50*KVA @ $.03924	$64,199.17	$68,185.51	$54,548.41	$54,548.41	$54,548.41	$54,548.41	$54,548.41	$54,548.41	$54,548.41	$54,548.41	$54,548.41	$59,739.95
100*KVA @ $.03404	$111,383.28	$118,299.43	$94,639.55	$94,639.55	$94,639.55	$94,639.55	$94,639.55	$94,639.55	$94,639.55	$94,639.55	$94,639.55	$103,646.68
250*KVA @ $.03084	$252,281.16	$267,946.13	$210,009.06	$184,103.46	$214,356.90	$214,356.90	$214,356.90	$214,356.90	$214,356.90	$212,784.66	$171,150.66	$234,757.89
EXCESS @ $.02864	$109,733.68	$65,836.89	$0.00	$0.00	$1,117.51	$51,810.31	$42,359.11	$32,907.91	$38,922.31	$0.00	$0.00	$28,370.85
ENERGY CHARGE	$537,597.29	$520,267.96	$359,197.01	$333,291.41	$364,662.37	$415,355.17	$405,903.97	$396,452.77	$402,467.17	$361,972.61	$320,338.61	$426,515.36
TOTAL CHARGE LESS ECA	$663,734.26	$654,227.26	$466,396.45	$440,490.85	$471,861.81	$522,554.61	$513,103.41	$503,652.21	$509,666.61	$469,172.05	$427,538.05	$543,902.06
SUMMARY												
MONTHLY DIFFERENCE	$68.81	$64.65	$43.40	$43.40	$51.72	$51.72	$51.72	$51.72	$51.72	$43.40	$43.40	$71.35
ANNUAL DIFFERENCE.............		**$637**										

NUMBER OF EXTERIOR SURFACES 14 RECTANGULAR 14 OTHER 0
(U-VALUE INCLUDES INSIDE AIR FILM PLUS OUTSIDE AIR FILM AT 7.5 MPH WINDSPEED)

SURFACE	SPACE	GLASS U-VALUE (BTU/HR-SQFT-F)	GLASS AREA (SQFT)	WALL U-VALUE (BTU/HR-SQFT-F)	WALL AREA (SQFT)	WALL+GLASS U-VALUE (BTU/HR-SQFT-F)	WALL+GLASS AREA (SQFT)	AZIMUTH
	SPACE_3	0.490	39.60	0.209	420.40	0.233	460.00	NORTH
	PLENUM_6	0.000	0.00	0.209	172.50	0.209	172.50	NORTH
	PLENUM_6	0.000	0.00	0.209	504.00	0.209	504.00	EAST
	SPACE_2	0.490	198.00	0.209	1146.00	0.251	1344.00	EAST
	PLENUM_6	0.000	0.00	0.209	172.50	0.209	172.50	SOUTH
	SPACE_4	0.490	78.00	0.209	382.00	0.257	460.00	SOUTH
	PLENUM_6	0.000	0.00	0.209	504.00	0.209	504.00	WEST
	SPACE_1	0.490	312.00	0.209	1032.00	0.274	1344.00	WEST
	SPACE_5	0.000	0.00	0.087	3795.00	0.087	3795.00	ROOF
	SPACE_1	0.000	0.00	0.087	2295.00	0.087	2295.00	ROOF
	SPACE_3	0.000	0.00	0.087	637.50	0.087	637.50	ROOF
	SPACE_2	0.000	0.00	0.087	2295.00	0.087	2295.00	ROOF
	SPACE_4	0.000	0.00	0.087	637.50	0.087	637.50	ROOF
	PLENUM_6	0.000	0.00	0.087	9660.00	0.087	9660.00	ROOF
	SPACE_1	0.000	0.00	0.020	2295.00	0.020	2295.00	UNDERGRND
	SPACE_2	0.000	0.00	0.020	2295.00	0.020	2295.00	UNDERGRND
	SPACE_3	0.000	0.00	0.020	637.50	0.020	637.50	UNDERGRND
	SPACE_4	0.000	0.00	0.020	637.50	0.020	637.50	UNDERGRND
	SPACE_5	0.000	0.00	0.020	3795.00	0.020	3795.00	UNDERGRND

EMC ENGINEERS INC. EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 3/ 1/1995 8:45:43 LDL RUN 1
DENVER, CO 80227 EXISTING CONDITION OF BLDG. 7665 DENTAL CLINIC
REPORT- LV-D DETAILS OF EXTERIOR SURFACES IN THE PROJECT TOPEKA, KS

	AVERAGE U-VALUE/GLASS (BTU/HR-SQFT-F)	AVERAGE U-VALUE/WALLS (BTU/HR-SQFT-F)	AVERAGE U-VALUE WALLS+GLASS (BTU/HR-SQFT-F)	GLASS AREA (SQFT)	OPAQUE AREA (SQFT)	GLASS+OPAQUE AREA (SQFT)
NORTH	0.490	0.209	0.227	39.60	592.90	632.50
EAST	0.490	0.209	0.239	198.00	1650.00	1848.00
SOUTH	0.490	0.209	0.244	78.00	554.50	632.50
WEST	0.490	0.209	0.257	312.00	1536.00	1848.00
ROOF	0.000	0.087	0.087	0.00	19320.00	19320.00
ALL WALLS	0.490	0.209	0.245	627.60	4333.40	4961.00
WALLS+ROOFS	0.490	0.109	0.119	627.60	23653.40	24281.00
UNDERGRND	0.000	0.020	0.020	0.00	9660.00	9660.00
BUILDING	0.490	0.083	0.091	627.60	33313.40	33941.00

*** BUILDING ***

FLOOR AREA	9645	SQFT	896	SQMT
VOLUME	106268	CUFT	3010	CUMT

	COOLING LOAD		HEATING LOAD	
TIME	AUG 11	4PM	JAN 15	8AM
DRY-BULB TEMP	100F	38C	-6F	-21C
WET-BULB TEMP	71F	22C	-7F	-22C

	COOLING SENSIBLE (KBTU/H)	COOLING SENSIBLE (KW)	COOLING LATENT (KBTU/H)	COOLING LATENT (KW)	HEATING SENSIBLE (KBTU/H)	HEATING SENSIBLE (KW)
WALLS	8.794	2.576	0.000	0.000	-46.897	-13.735
ROOFS	44.911	13.153	0.000	0.000	-71.534	-20.950
GLASS CONDUCTION	7.254	2.124	0.000	0.000	-24.039	-7.040
GLASS SOLAR	23.372	6.845	0.000	0.000	0.990	0.290
DOOR	0.000	0.000	0.000	0.000	0.000	0.000
INTERNAL SURFACES	0.000	0.000	0.000	0.000	0.000	0.000
UNDERGROUND SURFACES	-0.914	-0.268	0.000	0.000	-5.547	-1.625
OCCUPANTS TO SPACE	7.862	2.303	14.353	4.204	0.285	0.083
LIGHT TO SPACE	107.528	31.492	0.000	0.000	6.010	1.760
EQUIPMENT TO SPACE	31.414	9.200	0.000	0.000	1.138	0.333
PROCESS TO SPACE	0.000	0.000	0.000	0.000	0.000	0.000
INFILTRATION	0.000	0.000	0.000	0.000	0.000	0.000
TOTAL	230.221	67.426	14.353	4.204	-139.593	-40.883
TOTAL LOAD	244.573 KBTU/H		71.629 KW		-139.593 KBTU/H	-40.883 KW
TOTAL LOAD / AREA	25.36BTU/H.SQFT		79.939 W /SQMT		14.473BTU/H.SQFT	45.626 W /SQMT

NOTE
----
1) THE ABOVE LOADS EXCLUDE OUTSIDE VENTILATION AIR LOADS
2) TIMES GIVEN IN STANDARD TIME FOR THE LOCATION IN CONSIDERATION

EMC ENGINEERS INC. EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 3/ 1/1995 8:45:43 SDL RUN 1
DENVER, CO 80227 EXISTING CONDITION OF BLDG. 7665 DENTAL CLINIC
REPORT- SS-A SYSTEM MONTHLY LOADS SUMMARY FOR MZ_W/DX TOPEKA, KS

	COOLING						HEATING						ELEC	
MONTH	COOLING ENERGY (MBTU)	TIME OF MAX DY	HR	DRY-BULB TEMP	WET-BULB TEMP	MAXIMUM COOLING LOAD (KBTU/HR)	HEATING ENERGY (MBTU)	TIME OF MAX DY	HR	DRY-BULB TEMP	WET-BULB TEMP	MAXIMUM HEATING LOAD (KBTU/HR)	ELEC-TRICAL ENERGY (KWH)	MAXIMUM ELEC LOAD (KW)
JAN	0.00000					0.000	-71.674	15	8	-6.F	-7.F	-248.524	19885.	63.387
FEB	0.00000					0.000	-50.246	3	6	-1.F	-2.F	-213.459	17843.	63.387
MAR	0.00000					0.000	-43.945	14	6	15.F	13.F	-174.703	20637.	59.657
APR	0.00000					0.000	-37.770	22	18	67.F	52.F	-125.590	19390.	59.657
MAY	49.29276	16	4	60.F	58.F	432.150	-21.970	13	18	80.F	66.F	-133.556	24525.	93.094
JUN	108.18748	28	16	90.F	76.F	334.093	0.000					0.000	30710.	95.943
JUL	125.02094	13	16	93.F	77.F	346.475	0.000					0.000	32005.	98.637
AUG	126.65778	23	16	96.F	77.F	345.451	0.000					0.000	33980.	99.954
SEP	82.42660	7	16	93.F	76.F	332.205	0.000					0.000	27613.	97.000
OCT	1.01279	1	18	83.F	68.F	103.075	-32.961	6	18	67.F	52.F	-123.197	19358.	59.657
NOV	0.00000					0.000	-37.450	3	6	13.F	12.F	-152.486	18928.	59.657
DEC	0.00000					0.000	-61.674	12	6	3.F	2.F	-212.982	19717.	63.387
TOTAL	492.598						-357.689						284594.	
MAX						432.150						-248.524		99.954

D6-23

EMC ENGINEERS INC. EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 3/ 1/1995 8:45:43 SDL RUN 1
DENVER, CO 80227 EXISTING CONDITION OF BLDG. 7665 DENTAL CLINIC
REPORT- SS-C SYSTEM MONTHLY LOAD HOURS FOR MZ_W/DX TOPEKA, KS

	NUMBER OF HOURS										COINCIDENT LOADS	
MONTH	HOURS COOLING LOAD	HOURS HEATING LOAD	HOURS COINCIDENT COOL-HEAT LOAD	HOURS FLOATING	HOURS HEATING AVAIL.	HOURS COOLING AVAIL.	HOURS FANS ON	HOURS FANS CYCLE ON	HOURS NIGHT VENTING	HOURS FLOATING WHEN FANS ON	HEATING LOAD AT COOLING PEAK (KBTU/HR)	ELECTRIC LOAD AT COOLING PEAK (KW)
JAN	0	744	0	0	744	0	744	0	0	0	-50.099	13.455
FEB	0	672	0	0	672	0	672	0	0	0	-44.812	13.455
MAR	0	744	0	0	744	0	744	0	0	0	-51.198	13.455
APR	0	720	0	0	720	0	720	0	0	0	-65.631	13.455
MAY	384	360	0	0	360	384	744	0	0	0	0.000	50.696
JUN	720	0	0	0	0	720	720	0	0	0	0.000	95.943
JUL	744	0	0	0	0	744	744	0	0	0	0.000	98.637
AUG	744	0	0	0	0	744	744	0	0	0	0.000	99.891
SEP	692	0	0	28	0	720	720	0	0	28	0.000	97.000
OCT	17	720	0	7	720	24	744	0	0	7	0.000	24.993
NOV	0	720	0	0	720	0	720	0	0	0	-81.400	13.455
DEC	0	744	0	0	744	0	744	0	0	0	-140.673	13.455
ANNUAL	3301	5424	0	35	5424	3336	8760	0	0	35		

MO	UTILITY-	ELECTRICITY	NATURAL-GAS
	TOTAL(MBTU)	71.497	111.266
JAN	PEAK(KBTU)	221.954	333.842
	DY/HR	28/ 9	15/ 8
	TOTAL(MBTU)	64.007	81.921
FEB	PEAK(KBTU)	221.954	294.241
	DY/HR	3/ 8	3/ 6
	TOTAL(MBTU)	73.767	75.567
MAR	PEAK(KBTU)	209.218	249.270
	DY/HR	18/16	14/ 6
	TOTAL(MBTU)	69.471	67.610
APR	PEAK(KBTU)	209.218	190.465
	DY/HR	28/16	22/18
	TOTAL(MBTU)	85.435	38.028
MAY	PEAK(KBTU)	317.861	200.142
	DY/HR	16/16	13/18
	TOTAL(MBTU)	104.858	0.000
JUN	PEAK(KBTU)	327.591	0.000
	DY/HR	28/16	30/ 1
	TOTAL(MBTU)	109.280	0.000
JUL	PEAK(KBTU)	336.790	0.000
	DY/HR	13/16	31/ 1
	TOTAL(MBTU)	116.022	0.000
AUG	PEAK(KBTU)	341.287	0.000
	DY/HR	11/16	31/ 1
	TOTAL(MBTU)	94.283	0.000
SEP	PEAK(KBTU)	331.199	0.000
	DY/HR	7/16	30/ 1
	TOTAL(MBTU)	68.962	59.389
OCT	PEAK(KBTU)	209.218	187.549
	DY/HR	26/16	6/18
	TOTAL(MBTU)	67.571	65.410
NOV	PEAK(KBTU)	209.218	222.921
	DY/HR	23/16	3/ 6
	TOTAL(MBTU)	70.834	98.646
DEC	PEAK(KBTU)	221.954	293.695
	DY/HR	13/ 8	12/ 6
	ONE YEAR	995.986	597.835
	USE/PEAK	341.287	333.842

ENERGY TYPE IN SITE MBTU - CATEGORY OF USE	ELECTRICITY	NATURAL-GAS
SPACE HEAT	24.27	597.83
SPACE COOL	171.73	0.00
HVAC AUX	402.41	0.00
DOM HOT WTR	0.00	0.00
AUX SOLAR	0.00	0.00
LIGHTS	310.84	0.00
VERT TRANS	0.00	0.00
MISC EQUIP	86.71	0.00
TOTAL	995.96	597.83

TOTAL SITE ENERGY 1593.82 MBTU 165.0 KBTU/SQFT-YR GROSS-AREA 165.2 KBTU/SQFT-YR NET-AREA
TOTAL SOURCE ENERGY 3588.79 MBTU 371.5 KBTU/SQFT-YR GROSS-AREA 372.1 KBTU/SQFT-YR NET-AREA
PERCENT OF HOURS ANY SYSTEM ZONE OUTSIDE OF THROTTLING RANGE = 0.5
PERCENT OF HOURS ANY PLANT LOAD NOT SATISFIED = 0.0
NOTE ELECTRICITY AND/OR FUEL USED TO GENERATE ELECTRICITY IS APPORTIONED BASED ON THE YEARLY DEMAND. ALL OTHER ENERGY TYPES ARE APPORTIONED HOURLY.

EMC ENGINEERS INC. EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/22/1995 14:52: 3 SDL RUN 1
DENVER, CO 80227 PROPOSED MODIFICATION OF BLDG. 7665 DENTAL CLINIC
REPORT- SS-A SYSTEM MONTHLY LOADS SUMMARY FOR MZ_W/DX TOPEKA, KS

	- - - C O O L I N G - - -						- - - H E A T I N G - - -						- - - E L E C - - -	
MONTH	COOLING ENERGY (MBTU)	TIME OF MAX DY	TIME OF MAX HR	DRY-BULB TEMP	WET-BULB TEMP	MAXIMUM COOLING LOAD (KBTU/HR)	HEATING ENERGY (MBTU)	TIME OF MAX DY	TIME OF MAX HR	DRY-BULB TEMP	WET-BULB TEMP	MAXIMUM HEATING LOAD (KBTU/HR)	ELEC-TRICAL ENERGY (KWH)	MAXIMUM ELEC LOAD (KW)
JAN	0.00000					0.000	-98.610	15	7	-7.F	-8.F	-293.164	13027.	59.644
FEB	0.00000					0.000	-73.201	3	6	-1.F	-2.F	-260.375	11782.	59.644
MAR	0.00000					0.000	-57.754	14	6	15.F	13.F	-219.694	15145.	59.644
APR	0.00000					0.000	-30.262	5	6	31.F	28.F	-141.572	15274.	59.644
MAY	29.21634	16	2	62.F	59.F	284.324	-13.737	6	18	66.F	53.F	-94.050	17420.	78.786
JUN	70.66007	28	16	90.F	76.F	297.282	0.000					0.000	20390.	83.061
JUL	84.48312	13	16	93.F	77.F	311.718	0.000					0.000	20834.	86.164
AUG	88.16418	23	16	96.F	77.F	310.883	0.000					0.000	23078.	88.246
SEP	48.10788	7	16	93.F	76.F	295.943	0.000					0.000	17694.	84.015
OCT	0.11864	1	18	83.F	68.F	29.618	-23.892	31	6	44.F	39.F	-115.324	14989.	59.644
NOV	0.00000					0.000	-50.102	3	6	13.F	12.F	-204.884	13668.	59.644
DEC	0.00000					0.000	-88.418	12	6	3.F	2.F	-256.511	12881.	59.644
TOTAL	320.750						-435.977						196188.	
MAX						311.718						-293.164		88.246

EMC ENGINEERS INC. EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/22/1995 14:52: 3 SDL RUN 1
DENVER, CO 80227 PROPOSED MODIFICATION OF BLDG. 7665 DENTAL CLINIC
REPORT- SS-C SYSTEM MONTHLY LOAD HOURS FOR MZ_W/DX TOPEKA, KS

	- - - N U M B E R O F H O U R S - - -										--COINCIDENT LOADS--	
MONTH	HOURS COOLING LOAD	HOURS HEATING LOAD	HOURS COINCIDENT COOL-HEAT LOAD	HOURS FLOATING	HOURS HEATING AVAIL.	HOURS COOLING AVAIL.	HOURS FANS ON	HOURS FANS CYCLE ON	HOURS NIGHT VENTING	HOURS FLOATING WHEN FANS ON	HEATING LOAD AT COOLING PEAK (KBTU/HR)	ELECTRIC LOAD AT COOLING PEAK (KW)
JAN	0	744	0	0	744	0	744	0	0	0	-116.792	3.589
FEB	0	672	0	0	672	0	672	0	0	0	-106.977	3.589
MAR	0	744	0	0	744	0	744	0	0	0	-100.675	3.589
APR	0	720	0	0	720	0	720	0	0	0	-39.117	12.235
MAY	298	360	0	86	360	384	744	0	0	86	0.000	28.213
JUN	635	0	0	85	0	720	720	0	0	85	0.000	83.061
JUL	726	0	0	18	0	744	744	0	0	18	0.000	86.164
AUG	711	0	0	33	0	744	744	0	0	33	0.000	87.252
SEP	483	0	0	237	0	720	720	0	0	237	0.000	84.015
OCT	9	720	0	15	720	24	744	0	0	15	0.000	6.870
NOV	0	720	0	0	720	0	720	0	0	0	-147.718	3.589
DEC	0	744	0	0	744	0	744	0	0	0	-181.631	3.589
ANNUAL	2862	5424	0	474	5424	3336	8760	0	0	474		

MO	UTILITY-	ELECTRICITY	NATURAL-GAS
	TOTAL(MBTU)	48.841	149.171
JAN	PEAK(KBTU)	206.535	393.807
	DY/HR	31/14	15/ 7
	TOTAL(MBTU)	43.975	114.450
FEB	PEAK(KBTU)	206.223	356.878
	DY/HR	15/15	3/ 6
	TOTAL(MBTU)	55.321	94.823
MAR	PEAK(KBTU)	206.893	309.993
	DY/HR	31/13	14/ 6
	TOTAL(MBTU)	54.857	55.507
APR	PEAK(KBTU)	206.814	216.652
	DY/HR	8/ 8	5/ 6
	TOTAL(MBTU)	60.765	25.641
MAY	PEAK(KBTU)	269.010	157.743
	DY/HR	31/16	6/18
	TOTAL(MBTU)	69.621	0.000
JUN	PEAK(KBTU)	283.606	0.000
	DY/HR	28/16	30/ 1
	TOTAL(MBTU)	71.134	0.000
JUL	PEAK(KBTU)	294.200	0.000
	DY/HR	13/16	31/ 1
	TOTAL(MBTU)	78.798	0.000
AUG	PEAK(KBTU)	301.311	0.000
	DY/HR	11/16	31/ 1
	TOTAL(MBTU)	60.416	0.000
SEP	PEAK(KBTU)	286.863	0.000
	DY/HR	7/16	30/ 1
	TOTAL(MBTU)	53.392	44.806
OCT	PEAK(KBTU)	206.371	184.313
	DY/HR	20/11	31/ 6
	TOTAL(MBTU)	49.968	83.551
NOV	PEAK(KBTU)	206.954	292.632
	DY/HR	2/15	3/ 6
	TOTAL(MBTU)	48.282	136.590
DEC	PEAK(KBTU)	205.716	352.475
	DY/HR	1/14	12/ 6
	ONE YEAR	695.369	704.539
	USE/PEAK	301.311	393.807

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EMC        ENGINEERS       INC.        EZDOE - ELITE SOFTWARE DEVELOPMENT INC       DOE-2.1D   2/22/1995    14:52: 3  PDL RUN 1
  DENVER,        CO        80227       PROPOSED MODIFICATION OF BLDG. 7665     DENTAL CLINIC
REPORT- BEPS  ESTIMATED BUILDING ENERGY PERFORMANCE                                  TOPEKA, KS
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ENERGY TYPE IN SITE MBTU - CATEGORY OF USE	ELECTRICITY	NATURAL-GAS
SPACE HEAT	25.52	704.54
SPACE COOL	114.36	0.00
HVAC AUX	157.97	0.00
DOM HOT WTR	0.00	0.00
AUX SOLAR	0.00	0.00
LIGHTS	310.84	0.00
VERT TRANS	0.00	0.00
MISC EQUIP	86.71	0.00
TOTAL	695.40	704.54

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TOTAL SITE ENERGY       1399.91 MBTU    144.9 KBTU/SQFT-YR GROSS-AREA    145.1 KBTU/SQFT-YR NET-AREA
TOTAL SOURCE ENERGY     2792.74 MBTU    289.1 KBTU/SQFT-YR GROSS-AREA    289.6 KBTU/SQFT-YR NET-AREA
PERCENT OF HOURS ANY SYSTEM ZONE OUTSIDE OF THROTTLING RANGE = 29.8
PERCENT OF HOURS ANY PLANT LOAD NOT SATISFIED                =  0.0
NOTE  ELECTRICITY AND/OR FUEL USED TO GENERATE ELECTRICITY IS APPORTIONED BASED
      ON THE YEARLY DEMAND.  ALL OTHER ENERGY TYPES ARE APPORTIONED HOURLY.
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BUILDING 7670
ANNUAL ENERGY SAVINGS SUMMARY

Item	Baseline	ECO	Annual Energy Savings	Adj. Annual Energy Savings*
Annual Electric (MBTU)	1270.02	678.49	591.53	889.29
Annual Natural Gas (MBTU)	608.64	723.70	-115.06	-172.98
Electric Demand June (KW)	95.98	83.10	12.89	19.37
Electric Demand July (KW)	98.68	86.20	12.48	18.76
Electric Demand August (KW)	100.00	88.28	11.71	17.61

*Energy savings prorated on a square foot basis:

Baseline Model Bldg 7665 (sq.ft.)	9645
ECO Model Bldg 7670 (sq.ft.)	14500
Square Footage Adjustment Factor	1.503

LIFE CYCLE COST ANALYSIS SUMMARY
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

LOCATION:	Fort Riley	REGION: 2 (Kansas)		PROJECT NO:	1406-005
PROJECT TITLE:	Feasibility Study for HVAC Upgrade			FISCAL YEAR:	1995
ANALYSIS DATE:	05/08/95	ECONOMIC LIFE:	20	PREPARED BY:	C. Wohlert

1. INVESTMENT: **BLDG 7670 - Convert DD AHUs to DDs with VAV Units**

A.	CONSTRUCTION COST	=	$36,193	
B.	SIOH COST	(5.5% of 1A) =	$1,991	
C.	DESIGN COST	(6.0% of 1A) =	$2,172	
D.	TOTAL COST	(1A +1B +1C) =	$40,355	
E.	SALVAGE VALUE OF EXISTING EQUIPMENT =		$0	
F.	PUBLIC UTILITY COMPANY REBATE =		$0	
G.	TOTAL INVESTMENT	(1D -1E -1F) =	------->	$40,355

2. ENERGY SAVINGS (+) OR COST (-):

DATE OF NISTR 85-3273-9 USED FOR DISCOUNT FACTORS: JAN '95

	ENERGY SOURCE	FUEL COST $/MBTU (1)	SAVINGS MBTU/YR (2)	ANNUAL $ SAVINGS (3)	DISCOUNT FACTOR (4)	DISCOUNTED SAVINGS (5)	
A.	ELECT.	$12.10	889	$10,760	15.88	$170,875	
B.	DIST	$0.00	0	$0	19.16	$0	
C.	NAT GAS	$4.12	(173)	($713)	18.30	($13,042)	
D.	COAL	$0.00	0	$0	16.62	$0	
E.	ELEC. DEMAND			$958	14.88	$14,255	
F.	TOTAL		716	$11,006		-------->	$172,088

3. NON-ENERGY SAVINGS (+) OR COST (-)

A. ANNUAL RECURRING (+/-)

1 ANNUAL MAINTENANCE	$0	14.88	$0
2	$0	14.88	$0
3	$0	14.88	$0
4 TOTAL ANNUAL DISC. SAVINGS (+) / COST (	$0		$0

B. NON-RECURRING (+/-)

ITEM	SAVINGS (+) COST(-) (1)	YEAR OF OCCURRENCE (2)	DISCOUNT FACTOR (3) (TABLE A-2)	DISCOUNTED SAVINGS/COST (4)
a. BASELINE EQUIP. REPLCMNT.	$0	5	0.863	$0
b.				$0
c.				$0
d.				$0
e.				$0
f. TOTAL	$0			$0

C. TOTAL NON-ENERGY DISCOUNTED SAVINGS (+) OR COST (-) (3A4 + 3Bf4) = $0

4.	FIRST YEAR DOLLAR SAVINGS (+) / COSTS (-)	(2F3+3A4+(3Bf1/Economic Life))	$11,006
5.	SIMPLE PAYBACK (SPB) IN YEARS (MUST BE < 10 YEARS TO QUALIFY)	(1G/4) =	3.67
6.	TOTAL NET DISCOUNTED SAVINGS	(2F5 + 3C) =	$172,088
7.	DISCOUNTED SAVINGS-TO-INVESTMENT RATIO (SIR) (MUST HAVE SIR > 1.25 TO QUALIFY)	(6/1G) =	4.26

ENGINEER'S OPINION OF PROBABLE COST

PROJECT	Fort Riley Feasibility Study for HVAC Upgrade	**SHEET** 1 **OF** 1	
		DATE PREPARED	8-May-95
ENGINEER	E M C Engineers, Inc.	**ESTIMATOR**	C. Wohlert
	Denver, CO	**CHECKED BY**	A. Niemeyer

Line No.	Item Refer Code	Item Description	Unit of Measure	MATERIAL COST Quantity	Unit Cost	Total	LABOR COST Crew/ Worker	Hours/ Unit	Total	TOTAL
1		**BUILDING 7670**								
2		**PROPOSED SYSTEM MODIFICATIONS**								
3										
4	VSD15	VARIABLE SPEED DRIVE W/ CONTRLER,15HP	EA.	1	$4,060.11	$4,060	1-ELEC	38	$795	$4,855
5	E-TSTAT1	SINGLE SETPOINT ELEC. TSTAT, 3 WIRE	EA.	50	$24.23	$1,211	1-ELEC	0.8	$837	$2,048
6	WIRE#12	COPPER WIRING #12	C.L.F.	10	$7.41	$74	1-ELEC	0.727	$152	$226
7	VAVBX5	VAV BOX, 500 CFM, ELEC	EA.	36	$327.00	$11,772	1-SHEE	1.48	$1,109	$12,881
8	VAVBX8	VAV BOX, 800 CFM, ELEC	EA.	7	$331.40	$2,320	1-SHEE	1.5	$219	$2,538
9	VAVBX12	VAV BOX, 1200 CFM, ELEC	EA.	2	$334.30	$669	1-SHEE	1.7	$71	$739
10	VAVBX20	VAV BOX, 2000 CFM, ELEC	EA.	5	$345.90	$1,730	1-SHEE	1.83	$190	$1,920
11										
12										
13										
14										
15										
16										
17										
18										
19										
20										
21										
22										
23										
24										
25		*EXISTING SYSTEMS DEMOLITION*								
26		DUAL DUCT MIXING BOX DEMO	EA.	50.0			1-SHEE	3	$3,122	$3,122
27										
28										
29										
30										
31		**SUBTOTAL**				$17,775			$5,700	$23,475
32	OH	OVERHEAD			17%	$2,986			$958	$3,944
33	PRO	PROFIT			10%	$2,076			$666	$2,742
34	CONT	CONTINGENCY			20%	$4,568			$1,465	$6,032
35	**TOTAL COST**		-	-	-	$27,405	-	-	$8,788	$36,193

ENGINEER'S OPINION OF PROBABLE COST

PROJECT	Fort Riley Feasibility Study for HVAC Upgrade	**SHEET** 1 **OF** 1	
ENGINEER	E M C Engineers, Inc.	**DATE PREPARED**	1-Mar-95
	Denver, CO	**ESTIMATOR**	C. Wohlert
		CHECKED BY	A. Niemeyer

Line No.	Item Refer Code	Item Description	Unit of Measure	MATERIAL COST Quantity	MATERIAL COST Unit Cost	MATERIAL COST Total	LABOR COST Crew/ Worker	LABOR COST Hours/ Unit	LABOR COST Total	TOTAL
1		**BUILDING 7670**								
2		**NON-RECURRING**								
3										
4										
5										
6										
7										
8										
9										
10										
11										
12										
13										
14										
15										
16										
17										
18										
19										
20										
21										
22										
23										
24										
25										
26										
27										
28										
29										
30										
31		**SUBTOTAL**				$0			$0	$0
32	OH	OVERHEAD			17%	$0			$0	$0
33	PRO	PROFIT			10%	$0			$0	$0
34	CONT	CONTINGENCY			20%	$0			$0	$0
35	**TOTAL COST**		-	-	-	$0	-	-	$0	$0

ENGINEER'S OPINION OF PROBABLE COST

PROJECT	Fort Riley Feasibility Study for HVAC Upgrade	**SHEET**	1 **OF** 1
ENGINEER	E M C Engineers, Inc.	**DATE PREPARED**	1-Mar-95
	Denver, CO	**ESTIMATOR**	C. Wohlert
		CHECKED BY	A. Niemeyer

Line No.	Item Refer Code	Item Description	Unit of Measure	MATERIAL COST Quantity	MATERIAL COST Unit Cost	MATERIAL COST Total	LABOR COST Crew/ Worker	LABOR COST Hours/ Unit	LABOR COST Total	TOTAL
1		**BUILDING 7670**								
2		***ANNUAL RECURRING***								
3		***ANNUAL MAINTENANCE COST - BASELINE***								
4										
5										
6										
7										
8										
9										
10										
11										
12										
13										
14										
15	**TOTAL ANNUAL MAINTENANCE COST - BASELINE**		-	-	-	$0	-	-	$0	$0
16										
17		***ANNUAL MAINTENANCE COST - NEW HVAC REPLACEMENT***								
18										
19										
20										
21										
22										
23										
24										
25										
26										
27										
28										
29	**TOTAL ANNUAL MAINTENANCE COST - BASELINE**		-	-	-	$0	-	-	$0	$0
30										
31										
32										
33										
34										
35	**TOTAL ANNUAL MAINTENANCE COST SAVINGS**		-	-	-	$0	-	-	$0	$0

DEMAND LIMITING ANALYSIS BUILDING 7670

	1993	1993	1993	1993	1993	1993	1993	1993	1993	1993	1993	1993
SUMMER PEAK (KW) =	JUL BILL	AUG BILL	SEP BILL	OCT BILL	NOV BILL	DEC BILL	JAN BILL	FEB BILL	MAR BILL	APR BILL	MAY BILL	JUN BILL
27812	7/1-8/2	8/2-9/1	9/3-10/1	10/1-11/1	11/1-12/1	12/1-1/3	1/4-2/1	2/1-3/1	3/3-4/1	4/1-5/3	5/3-6/1	6/1-7/1
	ACTUAL	ACTUAL	ACTUAL	ACTUAL	ACTUAL	ACTUAL	ACTUAL	ACTUAL	ACTUAL	ACTUAL	ACTUAL	ACTUAL
BASE CASE												
CAPACITY (KW)	32472	34452	26136	20754	26400	22752	27108	25812	23310	21834	21996	30096
POWER FACTOR (%)	99.20%	99.10%	99.10%	99.90%	99.80%	99.70%	99.50%	99.60%	99.60%	99.80%	99.60%	98.80%
CAPACITY (KVA)	32734	34765	26373	20775	26453	22820	27244	25916	23404	21878	22084	30462
80% SUMMER PEAK (KVA)	27812	27812	27812	27812	27812	27812	27812	27812	27812	27812	27812	27812
CONTRACT MINIMUM (KVA)	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643
BILLING CAPACITY (KVA)	32734	34765	27812	27812	27812	27812	27812	27812	27812	27812	27812	30462
ACTUAL OR 80% PEAK	ACTUAL	ACTUAL	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	ACTUAL
200 KVA @ $4.45	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00
NEXT 400 @ $4.25	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00
REMAINING @ $4.05	$130,142.18	$138,367.78	$110,208.22	$110,208.22	$110,208.22	$110,208.22	$110,208.22	$110,208.22	$110,208.22	$110,208.22	$110,208.22	$120,939.23
SUB DISCOUNT $.20	($6,546.77)	($6,952.98)	($5,562.38)	($5,562.38)	($5,562.38)	($5,562.38)	($5,562.38)	($5,562.38)	($5,562.38)	($5,562.38)	($5,562.38)	($6,092.31)
CAPACITY CHARGE	$126,185.40	$134,004.80	$107,235.84	$107,235.84	$107,235.84	$107,235.84	$107,235.84	$107,235.84	$107,235.84	$107,235.84	$107,235.84	$117,436.92
TOTAL ENERGY (KWH)	16,920,000	16,200,000	10,980,000	10,140,000	11,160,000	12,930,000	12,600,000	12,270,000	12,480,000	11,070,000	9,720,000	13,170,000
50*KVA @ $.03924	$64,223.85	$68,208.70	$54,566.96	$54,566.96	$54,566.96	$54,566.96	$54,566.96	$54,566.96	$54,566.96	$54,566.96	$54,566.96	$59,765.54
100*KVA @ $.03404	$111,426.10	$118,339.66	$94,671.73	$94,671.73	$94,671.73	$94,671.73	$94,671.73	$94,671.73	$94,671.73	$94,671.73	$94,671.73	$103,691.08
250*KVA @ $.03084	$252,378.15	$268,037.26	$209,965.32	$184,059.72	$214,429.80	$214,429.80	$214,429.80	$214,429.80	$214,429.80	$212,740.92	$171,106.92	$234,858.46
EXCESS @ $.02864	$109,589.57	$65,701.49	$0.00	$0.00	$1,009.19	$51,701.99	$42,250.79	$32,799.59	$38,813.99	$0.00	$0.00	$28,221.42
ENERGY CHARGE	$537,617.67	$520,287.11	$359,204.01	$333,298.41	$364,677.69	$415,370.49	$405,919.29	$396,468.09	$402,482.49	$361,979.61	$320,345.61	$426,536.49
TOTAL CHARGE LESS ECA	$663,803.07	$654,291.92	$466,439.85	$440,534.25	$471,913.53	$522,606.33	$513,155.13	$503,703.93	$509,718.33	$469,215.45	$427,581.45	$543,973.42
DEMAND REDUCTION (KW)	**18.76**	**17.61**	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**19.37**
CAPACITY (KW)	32453	34434	26136	20754	26400	22752	27108	25812	23310	21834	21996	30077
POWER FACTOR (%)	99.20%	99.10%	99.10%	99.90%	99.80%	99.70%	99.50%	99.60%	99.60%	99.80%	99.60%	98.80%
CAPACITY (KVA)	32715	34747	26373	20775	26453	22820	27244	25916	23404	21878	22084	30442
80% SUMMER PEAK (KVA)	27798	27798	27798	27798	27798	27798	27798	27798	27798	27798	27798	27798
CONTRACT MINIMUM (KVA)	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643
BILLING CAPACITY (KVA)	32715	34747	27798	27798	27798	27798	27798	27798	27798	27798	27798	30442
ACTUAL OR 80% PEAK	ACTUAL	ACTUAL	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	ACTUAL
200 KVA @ $4.45	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00
NEXT 400 @ $4.25	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00
REMAINING @ $4.05	$130,065.59	$138,295.82	$110,150.65	$110,150.65	$110,150.65	$110,150.65	$110,150.65	$110,150.65	$110,150.65	$110,150.65	$110,150.65	$120,859.81
SUB DISCOUNT $.20	($6,542.99)	($6,949.42)	($5,559.54)	($5,559.54)	($5,559.54)	($5,559.54)	($5,559.54)	($5,559.54)	($5,559.54)	($5,559.54)	($5,559.54)	($6,088.39)
CAPACITY CHARGE	$126,112.59	$133,936.39	$107,181.12	$107,181.12	$107,181.12	$107,181.12	$107,181.12	$107,181.12	$107,181.12	$107,181.12	$107,181.12	$117,361.42
TOTAL ENERGY (KWH)	16,920,000	16,200,000	10,980,000	10,140,000	11,160,000	12,930,000	12,600,000	12,270,000	12,480,000	11,070,000	9,720,000	13,170,000
50*KVA @ $.03924	$64,186.75	$68,173.84	$54,539.07	$54,539.07	$54,539.07	$54,539.07	$54,539.07	$54,539.07	$54,539.07	$54,539.07	$54,539.07	$59,727.06
100*KVA @ $.03404	$111,361.72	$118,279.18	$94,623.34	$94,623.34	$94,623.34	$94,623.34	$94,623.34	$94,623.34	$94,623.34	$94,623.34	$94,623.34	$103,624.32
250*KVA @ $.03084	$252,232.34	$267,900.26	$210,031.08	$184,125.48	$214,320.21	$214,320.21	$214,320.21	$214,320.21	$214,320.21	$212,806.68	$171,172.68	$234,707.27
EXCESS @ $.02864	$109,806.22	$65,905.05	$0.00	$0.00	$1,172.04	$51,864.84	$42,413.64	$32,962.44	$38,976.84	$0.00	$0.00	$28,446.07
ENERGY CHARGE	$537,587.03	$520,258.33	$359,193.49	$333,287.89	$364,654.66	$415,347.46	$405,896.26	$396,445.06	$402,459.46	$361,969.09	$320,335.09	$426,504.72
TOTAL CHARGE LESS ECA	$663,699.63	$654,194.72	$466,374.61	$440,469.01	$471,835.78	$522,528.58	$513,077.38	$503,626.18	$509,640.58	$469,150.21	$427,516.21	$543,866.15
SUMMARY												
MONTHLY DIFFERENCE	$103.45	$97.19	$65.25	$65.25	$77.76	$77.76	$77.76	$77.76	$77.76	$65.25	$65.25	$107.27
ANNUAL DIFFERENCE..............		**$958**										

NUMBER OF EXTERIOR SURFACES 14 RECTANGULAR 14 OTHER 0
(U-VALUE INCLUDES INSIDE AIR FILM PLUS OUTSIDE AIR FILM AT 7.5 MPH WINDSPEED)

SURFACE	SPACE	- - - - G L A S S - - - - U-VALUE (BTU/HR-SQFT-F)	AREA (SQFT)	- - - - W A L L - - - - U-VALUE (BTU/HR-SQFT-F)	AREA (SQFT)	- W A L L + G L A S S - U-VALUE (BTU/HR-SQFT-F)	AREA (SQFT)	AZIMUTH
	SPACE_3	0.490	39.60	0.209	420.40	0.233	460.00	NORTH
	PLENUM_6	0.000	0.00	0.209	172.50	0.209	172.50	NORTH
	PLENUM_6	0.000	0.00	0.209	504.00	0.209	504.00	EAST
	SPACE_2	0.490	198.00	0.209	1146.00	0.251	1344.00	EAST
	PLENUM_6	0.000	0.00	0.209	172.50	0.209	172.50	SOUTH
	SPACE_4	0.490	78.00	0.209	382.00	0.257	460.00	SOUTH
	PLENUM_6	0.000	0.00	0.209	504.00	0.209	504.00	WEST
	SPACE_1	0.490	312.00	0.209	1032.00	0.274	1344.00	WEST
	SPACE_5	0.000	0.00	0.087	3795.00	0.087	3795.00	ROOF
	SPACE_1	0.000	0.00	0.087	2295.00	0.087	2295.00	ROOF
	SPACE_3	0.000	0.00	0.087	637.50	0.087	637.50	ROOF
	SPACE_2	0.000	0.00	0.087	2295.00	0.087	2295.00	ROOF
	SPACE_4	0.000	0.00	0.087	637.50	0.087	637.50	ROOF
	PLENUM_6	0.000	0.00	0.087	9660.00	0.087	9660.00	ROOF
	SPACE_1	0.000	0.00	0.020	2295.00	0.020	2295.00	UNDERGRND
	SPACE_2	0.000	0.00	0.020	2295.00	0.020	2295.00	UNDERGRND
	SPACE_3	0.000	0.00	0.020	637.50	0.020	637.50	UNDERGRND
	SPACE_4	0.000	0.00	0.020	637.50	0.020	637.50	UNDERGRND
	SPACE_5	0.000	0.00	0.020	3795.00	0.020	3795.00	UNDERGRND

EMC ENGINEERS INC. EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/28/1995 17:34:15 LDL RUN 1
DENVER, CO 80227 EXISTING CONDITION OF BLDG. 7670 DENTAL CLINIC
REPORT- LV-D DETAILS OF EXTERIOR SURFACES IN THE PROJECT TOPEKA, KS

	AVERAGE U-VALUE/GLASS (BTU/HR-SQFT-F)	AVERAGE U-VALUE/WALLS (BTU/HR-SQFT-F)	AVERAGE U-VALUE WALLS+GLASS (BTU/HR-SQFT-F)	GLASS AREA (SQFT)	OPAQUE AREA (SQFT)	GLASS+OPAQUE AREA (SQFT)
NORTH	0.490	0.209	0.227	39.60	592.90	632.50
EAST	0.490	0.209	0.239	198.00	1650.00	1848.00
SOUTH	0.490	0.209	0.244	78.00	554.50	632.50
WEST	0.490	0.209	0.257	312.00	1536.00	1848.00
ROOF	0.000	0.087	0.087	0.00	19320.00	19320.00
ALL WALLS	0.490	0.209	0.245	627.60	4333.40	4961.00
WALLS+ROOFS	0.490	0.109	0.119	627.60	23653.40	24281.00
UNDERGRND	0.000	0.020	0.020	0.00	9660.00	9660.00
BUILDING	0.490	0.083	0.091	627.60	33313.40	33941.00

REPORT- LS-C BUILDING PEAK LOAD COMPONENTS

*** BUILDING ***

FLOOR AREA 9645 SQFT 896 SQMT
VOLUME 106268 CUFT 3010 CUMT

	COOLING LOAD				HEATING LOAD	
TIME	AUG 11	4PM			JAN 15	8AM
DRY-BULB TEMP	100F	38C			-6F	-21C
WET-BULB TEMP	71F	22C			-7F	-22C
	SENSIBLE		LATENT		SENSIBLE	
	(KBTU/H)	(KW)	(KBTU/H)	(KW)	(KBTU/H)	(KW)
WALLS	8.794	2.576	0.000	0.000	-46.897	-13.735
ROOFS	44.911	13.153	0.000	0.000	-71.534	-20.950
GLASS CONDUCTION	7.254	2.124	0.000	0.000	-24.039	-7.040
GLASS SOLAR	23.372	6.845	0.000	0.000	0.990	0.290
DOOR	0.000	0.000	0.000	0.000	0.000	0.000
INTERNAL SURFACES	0.000	0.000	0.000	0.000	0.000	0.000
UNDERGROUND SURFACES	-0.914	-0.268	0.000	0.000	-5.547	-1.625
OCCUPANTS TO SPACE	7.862	2.303	14.353	4.204	0.285	0.083
LIGHT TO SPACE	107.528	31.492	0.000	0.000	6.010	1.760
EQUIPMENT TO SPACE	31.414	9.200	0.000	0.000	1.138	0.333
PROCESS TO SPACE	0.000	0.000	0.000	0.000	0.000	0.000
INFILTRATION	0.000	0.000	0.000	0.000	0.000	0.000
TOTAL	230.221	67.426	14.353	4.204	-139.593	-40.883
TOTAL LOAD	244.573 KBTU/H		71.629 KW		-139.593 KBTU/H	-40.883 KW
TOTAL LOAD / AREA	25.36BTU/H.SQFT		79.939 W /SQMT		14.473BTU/H.SQFT	45.626 W /SQMT

NOTE 1) THE ABOVE LOADS EXCLUDE OUTSIDE VENTILATION AIR LOADS
2) TIMES GIVEN IN STANDARD TIME FOR THE LOCATION IN CONSIDERATION

EMC ENGINEERS INC. EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/28/1995 17:34:15 SDL RUN 1
DENVER, CO 80227 EXISTING CONDITION OF BLDG. 7670 DENTAL CLINIC
REPORT- SS-A SYSTEM MONTHLY LOADS SUMMARY FOR DUAL_DUCT TOPEKA, KS

MONTH	COOLING ENERGY (MBTU)	COOLING TIME OF MAX DY	COOLING TIME OF MAX HR	COOLING DRY-BULB TEMP	COOLING WET-BULB TEMP	MAXIMUM COOLING LOAD (KBTU/HR)	HEATING ENERGY (MBTU)	HEATING TIME OF MAX DY	HEATING TIME OF MAX HR	HEATING DRY-BULB TEMP	HEATING WET-BULB TEMP	MAXIMUM HEATING LOAD (KBTU/HR)	ELEC ELECTRICAL ENERGY (KWH)	ELEC MAXIMUM ELEC LOAD (KW)
JAN	0.00000					0.000	-57.426	15	8	-6.F	-7.F	-218.388	25516.	67.457
FEB	0.00000					0.000	-39.102	3	6	-1.F	-2.F	-179.002	23062.	67.457
MAR	0.00000					0.000	-44.015	6	7	19.F	18.F	-136.201	26440.	67.457
APR	0.00000					0.000	-56.338	22	18	67.F	52.F	-165.788	25006.	67.457
MAY	60.03765	16	2	62.F	59.F	563.950	-33.741	13	18	80.F	66.F	-182.360	25516.	67.457
JUN	125.61597	28	16	90.F	76.F	356.360	0.000					0.000	25468.	67.457
JUL	142.58212	13	16	93.F	77.F	368.605	0.000					0.000	25054.	67.457
AUG	144.29832	23	16	96.F	77.F	367.669	0.000					0.000	26440.	67.457
SEP	100.69760	7	16	93.F	76.F	354.710	0.000					0.000	25006.	67.457
OCT	1.60873	1	18	83.F	68.F	131.074	-51.112	6	18	67.F	52.F	-157.027	25054.	67.457
NOV	0.00000					0.000	-38.996	23	18	63.F	52.F	-129.139	24544.	67.457
DEC	0.00000					0.000	-47.896	12	6	3.F	2.F	-185.054	25516.	67.457
TOTAL	574.841						-368.626						302611.	
MAX						563.950						-218.388		67.457

EMC ENGINEERS INC. EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/28/1995 17:34:15 SDL RUN 1
DENVER, CO 80227 EXISTING CONDITION OF BLDG. 7670 DENTAL CLINIC
REPORT- SS-C SYSTEM MONTHLY LOAD HOURS FOR DUAL_DUCT TOPEKA, KS

MONTH	HOURS COOLING LOAD	HOURS HEATING LOAD	HOURS COINCIDENT COOL-HEAT LOAD	HOURS FLOATING	HOURS HEATING AVAIL.	HOURS COOLING AVAIL.	HOURS FANS ON	HOURS FANS CYCLE ON	HOURS NIGHT VENTING	HOURS FLOATING WHEN FANS ON	COINCIDENT LOADS: HEATING LOAD AT COOLING PEAK (KBTU/HR)	COINCIDENT LOADS: ELECTRIC LOAD AT COOLING PEAK (KW)
JAN	0	744	0	0	744	0	744	0	0	0	-53.279	21.255
FEB	0	672	0	0	672	0	672	0	0	0	-47.569	21.255
MAR	0	744	0	0	744	0	744	0	0	0	-59.268	21.255
APR	0	720	0	0	720	0	720	0	0	0	-93.275	21.255
MAY	384	360	0	0	360	384	744	0	0	0	0.000	21.255
JUN	720	0	0	0	0	720	720	0	0	0	0.000	67.457
JUL	744	0	0	0	0	744	744	0	0	0	0.000	67.457
AUG	744	0	0	0	0	744	744	0	0	0	0.000	67.457
SEP	720	0	0	0	0	720	720	0	0	0	0.000	67.457
OCT	24	720	0	0	720	24	744	0	0	0	0.000	21.255
NOV	0	720	0	0	720	0	720	0	0	0	-58.184	21.255
DEC	0	744	0	0	744	0	744	0	0	0	-111.254	21.255
ANNUAL	3336	5424	0	0	5424	3336	8760	0	0	0		

MO	UTILITY-	ELECTRICITY	NATURAL-GAS
	TOTAL(MBTU)	90.363	91.393
JAN	PEAK(KBTU)	235.181	293.361
	DY/HR	28/10	15/ 8
	TOTAL(MBTU)	81.563	66.359
FEB	PEAK(KBTU)	235.181	248.719
	DY/HR	25/16	3/ 6
	TOTAL(MBTU)	93.633	75.746
MAR	PEAK(KBTU)	235.181	198.523
	DY/HR	31/16	6/ 7
	TOTAL(MBTU)	88.817	91.527
APR	PEAK(KBTU)	235.181	233.409
	DY/HR	29/16	22/18
	TOTAL(MBTU)	110.498	52.689
MAY	PEAK(KBTU)	354.062	252.582
	DY/HR	16/15	13/18
	TOTAL(MBTU)	132.744	0.000
JUN	PEAK(KBTU)	359.126	0.000
	DY/HR	28/16	30/ 1
	TOTAL(MBTU)	137.623	0.000
JUL	PEAK(KBTU)	366.189	0.000
	DY/HR	22/16	31/ 1
	TOTAL(MBTU)	144.414	0.000
AUG	PEAK(KBTU)	372.178	0.000
	DY/HR	11/16	31/ 1
	TOTAL(MBTU)	123.696	0.000
SEP	PEAK(KBTU)	362.746	0.000
	DY/HR	7/16	30/ 1
	TOTAL(MBTU)	89.603	84.105
OCT	PEAK(KBTU)	235.181	223.166
	DY/HR	31/16	6/18
	TOTAL(MBTU)	86.815	67.485
NOV	PEAK(KBTU)	235.181	190.072
	DY/HR	30/16	23/18
	TOTAL(MBTU)	90.285	79.335
DEC	PEAK(KBTU)	235.181	255.675
	DY/HR	23/16	12/ 6
	ONE YEAR	1270.055	608.638
	USE/PEAK	372.178	293.361

REPORT- BEPS ESTIMATED BUILDING ENERGY PERFORMANCE

ENERGY TYPE IN SITE MBTU - CATEGORY OF USE	ELECTRICITY	NATURAL-GAS
SPACE HEAT	24.03	608.64
SPACE COOL	187.62	0.00
HVAC AUX	660.84	0.00
DOM HOT WTR	0.00	0.00
AUX SOLAR	0.00	0.00
LIGHTS	310.83	0.00
VERT TRANS	0.00	0.00
MISC EQUIP	86.71	0.00
TOTAL	1270.02	608.64

TOTAL SITE ENERGY 1878.69 MBTU 194.5 KBTU/SQFT-YR GROSS-AREA 194.8 KBTU/SQFT-YR NET-AREA
TOTAL SOURCE ENERGY 4422.62 MBTU 457.8 KBTU/SQFT-YR GROSS-AREA 458.5 KBTU/SQFT-YR NET-AREA
PERCENT OF HOURS ANY SYSTEM ZONE OUTSIDE OF THROTTLING RANGE = 0.0
PERCENT OF HOURS ANY PLANT LOAD NOT SATISFIED = 0.0
NOTE ELECTRICITY AND/OR FUEL USED TO GENERATE ELECTRICITY IS APPORTIONED BASED ON THE YEARLY DEMAND. ALL OTHER ENERGY TYPES ARE APPORTIONED HOURLY.

EMC ENGINEERS INC. EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/28/1995 17: 6:24 SDL RUN 1
DENVER, CO 80227 PROPOSED MODIFICATION BLDG. 7670 DENTAL CLINIC
REPORT- SS-A SYSTEM MONTHLY LOADS SUMMARY FOR DUAL_DUCT TOPEKA, KS

MONTH	COOLING ENERGY (MBTU)	COOLING TIME OF MAX DY	COOLING TIME OF MAX HR	COOLING DRY-BULB TEMP	COOLING WET-BULB TEMP	MAXIMUM COOLING LOAD (KBTU/HR)	HEATING ENERGY (MBTU)	HEATING TIME OF MAX DY	HEATING TIME OF MAX HR	HEATING DRY-BULB TEMP	HEATING WET-BULB TEMP	MAXIMUM HEATING LOAD (KBTU/HR)	ELEC ELEC-TRICAL ENERGY (KWH)	ELEC MAXIMUM ELEC LOAD (KW)
JAN	0.00000					0.000	-99.970	15	7	-7.F	-8.F	-294.778	11324.	67.436
FEB	0.00000					0.000	-74.409	3	6	-1.F	-2.F	-261.983	10440.	67.436
MAR	0.00000					0.000	-59.934	14	6	15.F	13.F	-221.552	14416.	67.436
APR	0.00000					0.000	-32.239	4	6	32.F	31.F	-142.807	15928.	67.436
MAY	29.15188	16	16	80.F	68.F	281.222	-14.285	13	1	69.F	64.F	-98.890	15078.	67.436
JUN	71.47971	28	16	90.F	76.F	306.793	0.000					0.000	12730.	67.436
JUL	85.68158	13	16	93.F	77.F	321.658	0.000					0.000	11370.	67.436
AUG	89.44794	23	16	96.F	77.F	320.574	0.000					0.000	13033.	67.436
SEP	48.54211	7	16	93.F	76.F	305.178	0.000					0.000	12106.	67.436
OCT	0.10436	1	18	83.F	68.F	27.479	-25.425	31	6	44.F	39.F	-117.493	15731.	67.436
NOV	0.00000					0.000	-52.250	3	6	13.F	12.F	-205.326	13236.	67.436
DEC	0.00000					0.000	-89.954	12	6	3.F	2.F	-258.103	11301.	67.292
TOTAL	324.408						-448.465						156697.	
MAX						321.658						-294.778		67.436

EMC ENGINEERS INC. EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/28/1995 17: 6:24 SDL RUN 1
DENVER, CO 80227 PROPOSED MODIFICATION BLDG. 7670 DENTAL CLINIC
REPORT- SS-C SYSTEM MONTHLY LOAD HOURS FOR DUAL_DUCT TOPEKA, KS

MONTH	HOURS COOLING LOAD	HOURS HEATING LOAD	HOURS COINCIDENT COOL-HEAT LOAD	HOURS FLOATING	HOURS HEATING AVAIL.	HOURS COOLING AVAIL.	HOURS FANS ON	HOURS FANS CYCLE ON	HOURS NIGHT VENTING	HOURS FLOATING WHEN FANS ON	COINCIDENT LOADS HEATING LOAD AT COOLING PEAK (KBTU/HR)	COINCIDENT LOADS ELECTRIC LOAD AT COOLING PEAK (KW)
JAN	0	744	0	0	744	0	744	0	0	0	-119.820	0.978
FEB	0	672	0	0	672	0	672	0	0	0	-109.444	0.978
MAR	0	744	0	0	744	0	744	0	0	0	-100.393	0.978
APR	0	720	0	0	720	0	720	0	0	0	-61.483	3.962
MAY	291	360	0	93	360	384	744	0	0	93	0.000	54.735
JUN	626	0	0	94	0	720	720	0	0	94	0.000	54.158
JUL	715	0	0	29	0	744	744	0	0	29	0.000	54.824
AUG	705	0	0	39	0	744	744	0	0	39	0.000	54.776
SEP	483	0	0	237	0	720	720	0	0	237	0.000	54.155
OCT	8	720	0	16	720	24	744	0	0	16	0.000	0.978
NOV	0	720	0	0	720	0	720	0	0	0	-147.855	0.978
DEC	0	744	0	0	744	0	744	0	0	0	-183.170	0.978
ANNUAL	2828	5424	0	508	5424	3336	8760	0	0	508		

MO	UTILITY-	ELECTRICITY	NATURAL-GAS
	TOTAL(MBTU)	43.076	151.156
JAN	PEAK(KBTU)	233.308	395.976
	DY/HR	24/15	15/ 7
	TOTAL(MBTU)	39.446	116.271
FEB	PEAK(KBTU)	233.258	359.041
	DY/HR	14/16	3/ 6
	TOTAL(MBTU)	52.940	98.163
MAR	PEAK(KBTU)	233.854	312.458
	DY/HR	31/15	14/ 6
	TOTAL(MBTU)	57.215	58.697
APR	PEAK(KBTU)	232.490	218.401
	DY/HR	22/ 8	4/ 6
	TOTAL(MBTU)	63.175	26.467
MAY	PEAK(KBTU)	275.480	164.036
	DY/HR	31/16	13/ 1
	TOTAL(MBTU)	68.918	0.000
JUN	PEAK(KBTU)	287.284	0.000
	DY/HR	28/16	30/ 1
	TOTAL(MBTU)	69.555	0.000
JUL	PEAK(KBTU)	295.677	0.000
	DY/HR	13/16	31/ 1
	TOTAL(MBTU)	77.397	0.000
AUG	PEAK(KBTU)	303.856	0.000
	DY/HR	11/16	31/ 1
	TOTAL(MBTU)	59.121	0.000
SEP	PEAK(KBTU)	290.162	0.000
	DY/HR	7/16	30/ 1
	TOTAL(MBTU)	56.124	47.272
OCT	PEAK(KBTU)	232.936	187.232
	DY/HR	20/11	31/ 6
	TOTAL(MBTU)	48.594	86.812
NOV	PEAK(KBTU)	233.030	293.436
	DY/HR	1/13	3/ 6
	TOTAL(MBTU)	42.951	138.865
DEC	PEAK(KBTU)	232.694	354.621
	DY/HR	20/15	12/ 6
	ONE YEAR	678.511	723.704
	USE/PEAK	303.856	395.976

ENERGY TYPE IN SITE MBTU - CATEGORY OF USE	ELECTRICITY	NATURAL-GAS
SPACE HEAT	26.14	723.70
SPACE COOL	105.21	0.00
HVAC AUX	149.61	0.00
DOM HOT WTR	0.00	0.00
AUX SOLAR	0.00	0.00
LIGHTS	310.82	0.00
VERT TRANS	0.00	0.00
MISC EQUIP	86.71	0.00
TOTAL	678.49	723.70

TOTAL SITE ENERGY 1402.21 MBTU 145.2 KBTU/SQFT-YR GROSS-AREA 145.4 KBTU/SQFT-YR NET-AREA
TOTAL SOURCE ENERGY 2761.27 MBTU 285.8 KBTU/SQFT-YR GROSS-AREA 286.3 KBTU/SQFT-YR NET-AREA
PERCENT OF HOURS ANY SYSTEM ZONE OUTSIDE OF THROTTLING RANGE = 27.5
PERCENT OF HOURS ANY PLANT LOAD NOT SATISFIED = 0.0
NOTE ELECTRICITY AND/OR FUEL USED TO GENERATE ELECTRICITY IS APPORTIONED BASED ON THE YEARLY DEMAND. ALL OTHER ENERGY TYPES ARE APPORTIONED HOURLY.

BUILDING 7245A
ANNUAL ENERGY SAVINGS SUMMARY

Item	Baseline	ECO	Annual Energy Savings	Adj. Annual Energy Savings*
Annual Electric (MBTU)	989.81	702.46	287.35	287.35
Annual Natural Gas (MBTU)	832.82	1112.07	-279.25	-279.25
Electric Demand June (KW)	80.51	72.64	7.86	7.86
Electric Demand July (KW)	86.00	79.03	6.98	6.98
Electric Demand August (KW)	84.52	77.48	7.04	7.04

*Energy savings prorated on a square foot basis:

Baseline Model Bldg 7606A (sq.ft.)	7353.4
ECO Model Bldg 7245A (sq.ft.)	7353.4
Square Footage Adjustment Factor	1.000

LIFE CYCLE COST ANALYSIS SUMMARY
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

LOCATION:	Fort Riley	REGION: 2 (Kansas)		PROJECT NO:	1406-005
PROJECT TITLE:	Feasibility Study for HVAC Upgrade			FISCAL YEAR:	1995
ANALYSIS DATE:	05/04/95	ECONOMIC LIFE:	20	PREPARED BY:	C. Wohlert

1. INVESTMENT: **BLDG 7245 - Replace SZs AHUs In Dining area w/ VAV AHUs**

A.	CONSTRUCTION COST	=	$29,943	
B.	SIOH COST	(5.5% of 1A) =	$1,647	
C.	DESIGN COST	(6.0% of 1A) =	$1,797	
D.	TOTAL COST	(1A +1B +1C) =	$33,387	
E.	SALVAGE VALUE OF EXISTING EQUIPMENT =		$0	
F.	PUBLIC UTILITY COMPANY REBATE =		$0	
G.	TOTAL INVESTMENT	(1D -1E -1F) =	------->	$33,387

2. ENERGY SAVINGS (+) OR COST (-):
DATE OF NISTR 85-3273-9 USED FOR DISCOUNT FACTORS: <u>JAN '95</u>

	ENERGY SOURCE	FUEL COST $/MBTU (1)	SAVINGS MBTU/YR (2)	ANNUAL $ SAVINGS (3)	DISCOUNT FACTOR (4)	DISCOUNTED SAVINGS (5)	
A.	ELECT.	$12.10	287	$3,477	15.88	$55,214	
B.	DIST	$0.00	0	$0	19.16	$0	
C.	NAT GAS	$4.12	(279)	($1,151)	18.30	($21,054)	
D.	COAL	$0.00	0	$0	16.62	$0	
E.	ELEC. DEMAND			$381	14.88	$5,663	
F.	TOTAL		8	$2,707		-------->	$39,823

3. NON-ENERGY SAVINGS (+) OR COST (-)

A. ANNUAL RECURRING (+/-)

1 ANNUAL MAINTENANCE	$0	14.88	$0
2	$0	14.88	$0
3	$0	14.88	$0
4 TOTAL ANNUAL DISC. SAVINGS (+) / COST	$0		$0

B. NON-RECURRING (+/-)

ITEM	SAVINGS (+) COST(-) (1)	YEAR OF OCCURRENCE (2)	DISCOUNT FACTOR (3) (TABLE A-2)	DISCOUNTED SAVINGS/COST (4)
a. BASELINE EQUIP. REPLCMNT.	$21,050	5	0.863	$18,166
b.				$0
c.				$0
d.				$0
e.				$0
f. TOTAL	$21,050			$18,166

C. TOTAL NON-ENERGY DISCOUNTED SAVINGS (+) OR COST (-) (3A4 + 3Bf4) = $18,166

4.	FIRST YEAR DOLLAR SAVINGS (+) / COSTS (-)	(2F3+3A4+(3Bf1/Economic Life))	$3,759
5.	SIMPLE PAYBACK (SPB) IN YEARS (MUST BE < 10 YEARS TO QUALIFY)	(1G/4) =	8.88
6.	TOTAL NET DISCOUNTED SAVINGS	(2F5 + 3C) =	$57,988
7.	DISCOUNTED SAVINGS-TO-INVESTMENT RATIO (SIR) (MUST HAVE SIR > 1.25 TO QUALIFY)	(6/1G) =	1.74

ENGINEER'S OPINION OF PROBABLE COST

PROJECT	Fort Riley Feasibility Study for HVAC Upgrade	**SHEET**	1 OF 1
ENGINEER	E M C Engineers, Inc.	**DATE PREPARED**	4-May-95
	Denver, CO	**ESTIMATOR**	C. Wohlert
		CHECKED BY	A. Niemeyer

Line No.	Item Refer Code	Item Description	Unit of Measure	MATERIAL COST Quantity	MATERIAL COST Unit Cost	MATERIAL COST Total	LABOR COST Crew/ Worker	LABOR COST Hours/ Unit	LABOR COST Total	TOTAL
1		**BUILDING 7245**								
2		**PROPOSED SYSTEM MODIFICATIONS**								
3										
4		*NEW SYSTEMS INSTALLATION*								
5	AHU8000	8,000 CFM AHU, COOLING ONLY	EA.	2.0	$4,433.18	$8,866	Q-6	40	$1,608	$10,475
6	E-TSTAT1	SINGLE SETPOINT ELEC. TSTAT, 3 WIRE	EA.	2.0	$24.23	$48	1-ELEC	0.8	$33	$82
7	WIRE#12	COPPER WIRING #12	C.L.F.	1.5	$7.41	$11	1-ELEC	0.727	$23	$34
8	STLPIP1.5	STEEL PIPE SCH. 40, 1.5" W/HANGERS	L.F.	60.0	$2.95	$177	Q-1	0.2	$233	$409
9		FITTINGS ADD 5%				$9			$12	$20
10	INSLPIP1.5	1.25" FIBERGLASS PIPE INSULATION, 1.5" THCK	L.F.	60.0	$1.40	$84	Q-14	0.08	$88	$172
11	CNTV1	CONTROL VALVE 1"	EA.	2.0	$190.89	$382	1-PLUM	0.471	$20	$402
12	VSD5	VARIABLE SPEED DRIVE W/ CONTRLER,5HP	EA.	2.0	$2,444.79	$4,890	1-ELEC	21	$879	$5,769
13	DUCT500	GAL. STEEL DUCTWORK, 200 TO 500 LB.	LB.	300.0	$0.47	$140	Q-10	0.098	$571	$711
14	DTINSL1"	DUCT INSLULATION, 1" THICK	S.F.	300.0	$0.48	$145	Q-14	0.046	$254	$399
15										
16										
17										
18										
19										
20										
21										
22										
23										
24										
25		*EXISTING SYSTEMS DEMOLITION*								
26		AHU DEMO	TON	2.8			Q-5	17.778	$948	$948
27										
28										
29										
30										
31		**SUBTOTAL**				$14,751			$4,670	$19,421
32	OH	OVERHEAD			17%	$2,478			$785	$3,263
33	PRO	PROFIT			10%	$1,723			$545	$2,268
34	CONT	CONTINGENCY			20%	$3,791			$1,200	$4,991
35	**TOTAL COST**		-	-	-	$22,743	-	-	$7,200	$29,943

ENGINEER'S OPINION OF PROBABLE COST

PROJECT	Fort Riley Feasibility Study for HVAC Upgrade	**SHEET**	1 **OF** 1
ENGINEER	E M C Engineers, Inc.	**DATE PREPARED**	4-May-95
	Denver, CO	**ESTIMATOR**	C. Wohlert
		CHECKED BY	A. Niemeyer

Line No.	Item Refer Code	Item Description	Unit of Measure	MATERIAL COST			LABOR COST			TOTAL
				Quantity	Unit Cost	Total	Crew/ Worker	Hours/ Unit	Total	
1		**BUILDING 7245**								
2		**NON-RECURRING**								
3										
4		*EXISTING SYSTEM REPLACEMENT*								
5	AHU8000	8,000 CFM AHU, COOLING ONLY	EA.	2.0	$4,433.18	$8,866	Q-6	40	$1,608	$10,475
6	DUCT500	GAL. STEEL DUCTWORK, 200 TO 500 LB.	LB.	300.0	$0.47	$140	Q-10	0.098	$571	$711
7	E-TSTAT1	SINGLE SETPOINT ELEC. TSTAT, 3 WIRE	EA.	2.0	$24.23	$48	1-ELEC	0.8	$33	$82
8	WIRE#12	COPPER WIRING #12	C.L.F.	1.5	$7.41	$11	1-ELEC	0.727	$23	$34
9	STLPIP1.5	STEEL PIPE SCH. 40, 1.5" W/HANGERS	L.F.	60.0	$2.95	$177	Q-1	0.2	$233	$409
10		FITTINGS ADD 5%				$9			$12	$20
11	INSLPIP1.5	1.25" FIBERGLASS PIPE INSULATION, 1.5" THCK	L.F.	60.0	$1.40	$84	Q-14	0.08	$88	$172
12	CNTV1	CONTROL VALVE 1"	EA.	2.0	$190.89	$382	1-PLUM	0.471	$20	$402
13	DTINSL1"	DUCT INSLULATION, 1" THICK	S.F.	300.0	$0.48	$145	Q-14	0.046	$254	$399
14										
15										
16										
17										
18										
19										
20										
21										
22		*EXISTING SYSTEMS DEMOLITION*								
23		AHU DEMO	TON	2.8			Q-5	17.778	$948	$948
24										
25										
26										
27										
28										
29										
30										
31		**SUBTOTAL**				$9,862			$3,791	$13,653
32	OH	OVERHEAD			17%	$1,657			$637	$2,294
33	PRO	PROFIT			10%	$1,152			$443	$1,595
34	CONT	CONTINGENCY			20%	$2,534			$974	$3,508
35	**TOTAL COST**		-	-	-	$15,205	-	-	$5,845	$21,050

ENGINEER'S OPINION OF PROBABLE COST

PROJECT	Fort Riley Feasibility Study for HVAC Upgrade	**SHEET** 1 **OF** 1	
		DATE PREPARED	2-Mar-95
ENGINEER	E M C Engineers, Inc.	**ESTIMATOR**	C. Wohlert
	Denver, CO	**CHECKED BY**	A. Niemeyer

Line No.	Item Refer Code	Item Description	Unit of Measure	MATERIAL COST Quantity	MATERIAL COST Unit Cost	MATERIAL COST Total	LABOR COST Crew/ Worker	LABOR COST Hours/ Unit	LABOR COST Total	TOTAL
1		**BUILDING 7245**								
2		***ANNUAL RECURRING***								
3		***ANNUAL MAINTENANCE COST - BASELINE***								
4										
5										
6										
7										
8										
9										
10										
11										
12										
13										
14										
15	**TOTAL ANNUAL MAINTENANCE COST - BASELINE**		-	-	-	$0	-	-	$0	$0
16										
17		***ANNUAL MAINTENANCE COST - NEW HVAC REPLACEMENT***								
18										
19										
20										
21										
22										
23										
24										
25										
26										
27										
28										
29	**TOTAL ANNUAL MAINTENANCE COST - BASELINE**		-	-	-	$0	-	-	$0	$0
30										
31										
32										
33										
34										
35	**TOTAL ANNUAL MAINTENANCE COST SAVINGS**		-	-	-	$0	-	-	$0	$0

DEMAND LIMITING ANALYSIS BUILDING 7245A

SUMMER PEAK (KW) = 27812	1993 JUL BILL 7/1-8/2 ACTUAL	1993 AUG BILL 8/2-9/1 ACTUAL	1993 SEP BILL 9/3-10/1 ACTUAL	1993 OCT BILL 10/1-11/1 ACTUAL	1993 NOV BILL 11/1-12/1 ACTUAL	1993 DEC BILL 12/1-1/3 ACTUAL	1993 JAN BILL 1/4-2/1 ACTUAL	1993 FEB BILL 2/1-3/1 ACTUAL	1993 MAR BILL 3/3-4/1 ACTUAL	1993 APR BILL 4/1-5/3 ACTUAL	1993 MAY BILL 5/3-6/1 ACTUAL	1993 JUN BILL 6/1-7/1 ACTUAL
BASE CASE												
CAPACITY (KW)	32472	34452	26136	20754	26400	22752	27108	25812	23310	21834	21996	30096
POWER FACTOR (%)	99.20%	99.10%	99.10%	99.90%	99.80%	99.70%	99.50%	99.60%	99.60%	99.80%	99.60%	98.80%
CAPACITY (KVA)	32734	34765	26373	20775	26453	22820	27244	25916	23404	21878	22084	30462
80% SUMMER PEAK (KVA)	27812	27812	27812	27812	27812	27812	27812	27812	27812	27812	27812	27812
CONTRACT MINIMUM (KVA)	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643
BILLING CAPACITY (KVA)	32734	34765	27812	27812	27812	27812	27812	27812	27812	27812	27812	30462
ACTUAL OR 80% PEAK	ACTUAL	ACTUAL	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	ACTUAL
200 KVA @ $4.45	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00
NEXT 400 @ $4.25	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00
REMAINING @ $4.05	$130,142.18	$138,367.78	$110,208.22	$110,208.22	$110,208.22	$110,208.22	$110,208.22	$110,208.22	$110,208.22	$110,208.22	$110,208.22	$120,939.23
SUB DISCOUNT $.20	($6,546.77)	($6,952.98)	($5,562.38)	($5,562.38)	($5,562.38)	($5,562.38)	($5,562.38)	($5,562.38)	($5,562.38)	($5,562.38)	($5,562.38)	($6,092.31)
CAPACITY CHARGE	$126,185.40	$134,004.80	$107,235.84	$107,235.84	$107,235.84	$107,235.84	$107,235.84	$107,235.84	$107,235.84	$107,235.84	$107,235.84	$117,436.92
TOTAL ENERGY (KWH)	16,920,000	16,200,000	10,980,000	10,140,000	11,160,000	12,930,000	12,600,000	12,270,000	12,480,000	11,070,000	9,720,000	13,170,000
50*KVA @ $.03924	$64,223.85	$68,208.70	$54,566.96	$54,566.96	$54,566.96	$54,566.96	$54,566.96	$54,566.96	$54,566.96	$54,566.96	$54,566.96	$59,765.54
100*KVA @ $.03404	$111,426.10	$118,339.66	$94,671.73	$94,671.73	$94,671.73	$94,671.73	$94,671.73	$94,671.73	$94,671.73	$94,671.73	$94,671.73	$103,691.08
250*KVA @ $.03084	$252,378.15	$268,037.26	$209,965.32	$184,059.72	$214,429.80	$214,429.80	$214,429.80	$214,429.80	$214,429.80	$212,740.92	$171,106.92	$234,858.46
EXCESS @ $.02864	$109,589.57	$65,701.49	$0.00	$0.00	$1,009.19	$51,701.99	$42,250.79	$32,799.59	$38,813.99	$0.00	$0.00	$28,221.42
ENERGY CHARGE	$537,617.67	$520,287.11	$359,204.01	$333,298.41	$364,677.69	$415,370.49	$405,919.29	$396,468.09	$402,482.49	$361,979.61	$320,345.61	$426,536.49
TOTAL CHARGE LESS ECA	$663,803.07	$654,291.92	$466,439.85	$440,534.25	$471,913.53	$522,606.33	$513,155.13	$503,703.93	$509,718.33	$469,215.45	$427,581.45	$543,973.42
DEMAND REDUCTION (KW)	**6.98**	**7.04**	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**7.86**
CAPACITY (KW)	32465	34445	26136	20754	26400	22752	27108	25812	23310	21834	21996	30088
POWER FACTOR (%)	99.20%	99.10%	99.10%	99.90%	99.80%	99.70%	99.50%	99.60%	99.60%	99.80%	99.60%	98.80%
CAPACITY (KVA)	32727	34758	26373	20775	26453	22820	27244	25916	23404	21878	22084	30454
80% SUMMER PEAK (KVA)	27806	27806	27806	27806	27806	27806	27806	27806	27806	27806	27806	27806
CONTRACT MINIMUM (KVA)	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643
BILLING CAPACITY (KVA)	32727	34758	27806	27806	27806	27806	27806	27806	27806	27806	27806	30454
ACTUAL OR 80% PEAK	ACTUAL	ACTUAL	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	ACTUAL
200 KVA @ $4.45	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00
NEXT 400 @ $4.25	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00
REMAINING @ $4.05	$130,113.70	$138,339.01	$110,185.21	$110,185.21	$110,185.21	$110,185.21	$110,185.21	$110,185.21	$110,185.21	$110,185.21	$110,185.21	$120,907.00
SUB DISCOUNT $.20	($6,545.37)	($6,951.56)	($5,561.24)	($5,561.24)	($5,561.24)	($5,561.24)	($5,561.24)	($5,561.24)	($5,561.24)	($5,561.24)	($5,561.24)	($6,090.72)
CAPACITY CHARGE	$126,158.33	$133,977.46	$107,213.97	$107,213.97	$107,213.97	$107,213.97	$107,213.97	$107,213.97	$107,213.97	$107,213.97	$107,213.97	$117,406.28
TOTAL ENERGY (KWH)	16,920,000	16,200,000	10,980,000	10,140,000	11,160,000	12,930,000	12,600,000	12,270,000	12,480,000	11,070,000	9,720,000	13,170,000
50*KVA @ $.03924	$64,210.06	$68,194.77	$54,555.81	$54,555.81	$54,555.81	$54,555.81	$54,555.81	$54,555.81	$54,555.81	$54,555.81	$54,555.81	$59,749.92
100*KVA @ $.03404	$111,402.16	$118,315.49	$94,652.39	$94,652.39	$94,652.39	$94,652.39	$94,652.39	$94,652.39	$94,652.39	$94,652.39	$94,652.39	$103,663.99
250*KVA @ $.03084	$252,323.93	$267,982.49	$209,991.60	$184,086.00	$214,385.99	$214,385.99	$214,385.99	$214,385.99	$214,385.99	$212,767.20	$171,133.20	$234,797.10
EXCESS @ $.02864	$109,670.13	$65,782.86	$0.00	$0.00	$1,074.29	$51,767.09	$42,315.89	$32,864.69	$38,879.09	$0.00	$0.00	$28,312.59
ENERGY CHARGE	$537,606.28	$520,275.61	$359,199.81	$333,294.21	$364,668.48	$415,361.28	$405,910.08	$396,458.88	$402,473.28	$361,975.41	$320,341.41	$426,523.60
TOTAL CHARGE LESS ECA	$663,764.61	$654,253.06	$466,413.77	$440,508.17	$471,882.45	$522,575.25	$513,124.05	$503,672.85	$509,687.25	$469,189.37	$427,555.37	$543,929.88
SUMMARY												
MONTHLY DIFFERENCE	$38.46	$38.85	$26.08	$26.08	$31.08	$31.08	$31.08	$31.08	$31.08	$26.08	$26.08	$43.53
ANNUAL DIFFERENCE..............		**$380.59**										

NUMBER OF EXTERIOR SURFACES 7 RECTANGULAR 7 OTHER 0
(U-VALUE INCLUDES INSIDE AIR FILM PLUS OUTSIDE AIR FILM AT 7.5 MPH WINDSPEED)

SURFACE	SPACE	GLASS U-VALUE (BTU/HR-SQFT-F)	GLASS AREA (SQFT)	WALL U-VALUE (BTU/HR-SQFT-F)	WALL AREA (SQFT)	WALL+GLASS U-VALUE (BTU/HR-SQFT-F)	WALL+GLASS AREA (SQFT)	AZIMUTH
	diningarea	1.021	192.00	0.082	722.78	0.279	914.78	NORTH-EAST
	dining-plm	0.000	0.00	0.082	690.40	0.082	690.40	NORTH-EAST
	diningarea	1.021	576.00	0.082	452.20	0.608	1028.20	SOUTH-EAST
	dining-plm	0.000	0.00	0.082	776.00	0.082	776.00	SOUTH-EAST
	diningarea	1.021	576.00	0.082	452.20	0.608	1028.20	NORTH-WEST
	dining-plm	0.000	0.00	0.082	776.00	0.082	776.00	NORTH-WEST
	dining-plm	0.000	0.00	0.838	7353.00	0.838	7353.00	ROOF
	diningarea	0.000	0.00	0.020	7353.00	0.020	7353.00	UNDERGRND

EMC ENGINEERS INC. EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 3/ 2/1995 8:26: 5 LDL RUN 1
DENVER, CO 80227 EXISTING SIMULATION FOR BLDG. 7245 DINING AREA
REPORT- LV-D DETAILS OF EXTERIOR SURFACES IN THE PROJECT TOPEKA, KS

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	AVERAGE U-VALUE/GLASS (BTU/HR-SQFT-F)	AVERAGE U-VALUE/WALLS (BTU/HR-SQFT-F)	AVERAGE U-VALUE WALLS+GLASS (BTU/HR-SQFT-F)	GLASS AREA (SQFT)	OPAQUE AREA (SQFT)	GLASS+OPAQUE AREA (SQFT)
NORTH-EAST	1.021	0.082	0.194	192.00	1413.18	1605.18
SOUTH-EAST	1.021	0.082	0.382	576.00	1228.20	1804.20
NORTH-WEST	1.021	0.082	0.382	576.00	1228.20	1804.20
ROOF	0.000	0.838	0.838	0.00	7353.00	7353.00
ALL WALLS	1.021	0.082	0.324	1344.00	3869.58	5213.58
WALLS+ROOFS	1.021	0.577	0.625	1344.00	11222.58	12566.58
UNDERGRND	0.000	0.020	0.020	0.00	7353.00	7353.00
BUILDING	1.021	0.357	0.401	1344.00	18575.58	19919.58

REPORT- LS-C BUILDING PEAK LOAD COMPONENTS

*** BUILDING ***

FLOOR AREA	7353	SQFT	683	SQMT
VOLUME	78436	CUFT	2221	CUMT

	COOLING LOAD				HEATING LOAD	
TIME	JUL 23	7PM			JAN 28	4AM
DRY-BULB TEMP	94F	34C			0F	-18C
WET-BULB TEMP	78F	26C			-2F	-19C
	SENSIBLE		LATENT		SENSIBLE	
	(KBTU/H)	(KW)	(KBTU/H)	(KW)	(KBTU/H)	(KW)
WALLS	2.101	0.615	0.000	0.000	-9.047	-2.650
ROOFS	0.000	0.000	0.000	0.000	0.000	0.000
GLASS CONDUCTION	23.361	6.842	0.000	0.000	-108.011	-31.634
GLASS SOLAR	71.431	20.920	0.000	0.000	2.054	0.601
DOOR	0.000	0.000	0.000	0.000	0.000	0.000
INTERNAL SURFACES	0.000	0.000	0.000	0.000	0.000	0.000
UNDERGROUND SURFACES	-1.320	-0.387	0.000	0.000	-4.222	-1.237
OCCUPANTS TO SPACE	57.211	16.756	117.843	34.513	4.102	1.202
LIGHT TO SPACE	47.596	13.940	0.000	0.000	8.158	2.389
EQUIPMENT TO SPACE	20.307	5.947	0.000	0.000	1.456	0.426
PROCESS TO SPACE	0.000	0.000	0.000	0.000	0.000	0.000
INFILTRATION	0.000	0.000	0.000	0.000	0.000	0.000
TOTAL	220.687	64.634	117.843	34.513	-105.509	-30.901
TOTAL LOAD	338.530 KBTU/H		99.147	KW	-105.509 KBTU/H	-30.901 KW
TOTAL LOAD / AREA	46.04BTU/H.SQFT		145.131	W /SQMT	14.348BTU/H.SQFT	45.233 W /SQMT

NOTE 1) THE ABOVE LOADS EXCLUDE OUTSIDE VENTILATION AIR LOADS
---- 2) TIMES GIVEN IN STANDARD TIME FOR THE LOCATION IN CONSIDERATION

EMC ENGINEERS INC. EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 3/ 2/1995 8:26: 5 SDL RUN 1
DENVER, CO 80227 EXISTING SIMULATION FOR BLDG. 7245 DINING AREA
REPORT- SS-A SYSTEM MONTHLY LOADS SUMMARY FOR SMALL-SZ TOPEKA, KS

MONTH	COOLING: COOLING ENERGY (MBTU)	COOLING: TIME OF MAX DY	COOLING: TIME OF MAX HR	COOLING: DRY-BULB TEMP	COOLING: WET-BULB TEMP	COOLING: MAXIMUM COOLING LOAD (KBTU/HR)	HEATING: HEATING ENERGY (MBTU)	HEATING: TIME OF MAX DY	HEATING: TIME OF MAX HR	HEATING: DRY-BULB TEMP	HEATING: WET-BULB TEMP	HEATING: MAXIMUM HEATING LOAD (KBTU/HR)	ELEC: ELEC-TRICAL ENERGY (KWH)	ELEC: MAXIMUM ELEC LOAD (KW)
JAN	0.00000					0.000	-138.465	15	3	-8.F	-9.F	-456.157	17156.	33.166
FEB	0.00000					0.000	-98.040	3	4	0.F	-1.F	-400.275	15496.	33.166
MAR	0.00000					0.000	-69.278	3	4	16.F	13.F	-313.025	17156.	33.166
APR	0.00000					0.000	-14.841	5	4	32.F	29.F	-196.522	16603.	33.166
MAY	62.13005	31	18	90.F	76.F	486.319	-2.311	5	4	45.F	41.F	-98.902	17156.	33.166
JUN	154.77917	28	18	89.F	76.F	495.490	0.000					0.000	16603.	33.166
JUL	194.05418	23	18	95.F	79.F	553.431	0.000					0.000	17156.	33.166
AUG	187.13864	21	19	95.F	76.F	509.200	0.000					0.000	17156.	33.166
SEP	105.22019	5	18	90.F	77.F	487.716	0.000					0.000	16603.	33.166
OCT	2.43536	1	18	83.F	68.F	326.556	-12.878	20	3	25.F	25.F	-227.752	17156.	33.166
NOV	0.00000					0.000	-56.612	3	4	13.F	12.F	-304.667	16603.	33.166
DEC	0.00000					0.000	-121.945	15	2	3.F	2.F	-381.882	17156.	33.166
TOTAL	705.758						-514.370						201990.	
MAX						553.431						-456.157		33.166

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EMC ENGINEERS INC. EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 3/ 2/1995 8:26: 5 SDL RUN 1
DENVER, CO 80227 EXISTING SIMULATION FOR BLDG. 7245 DINING AREA
REPORT- SS-C SYSTEM MONTHLY LOAD HOURS FOR SMALL-SZ TOPEKA, KS

MONTH	HOURS COOLING LOAD	HOURS HEATING LOAD	HOURS COINCIDENT COOL-HEAT LOAD	HOURS FLOATING	HOURS HEATING AVAIL.	HOURS COOLING AVAIL.	HOURS FANS ON	HOURS FANS CYCLE ON	HOURS NIGHT VENTING	HOURS FLOATING WHEN FANS ON	COINCIDENT LOADS: HEATING LOAD AT COOLING PEAK (KBTU/HR)	COINCIDENT LOADS: ELECTRIC LOAD AT COOLING PEAK (KW)
JAN	0	735	0	9	744	0	744	0	0	9	-186.407	11.115
FEB	0	641	0	31	672	0	672	0	0	31	-180.348	11.115
MAR	0	637	0	107	744	0	744	0	0	107	-178.966	11.115
APR	0	434	0	286	720	0	720	0	0	286	-9.427	11.115
MAY	374	182	0	188	360	375	744	0	0	188	0.000	33.166
JUN	708	0	0	12	0	709	720	0	0	12	0.000	33.166
JUL	744	0	0	0	0	744	744	0	0	0	0.000	33.166
AUG	743	0	0	1	0	744	744	0	0	1	0.000	33.166
SEP	585	0	0	135	0	590	720	0	0	135	0.000	33.166
OCT	15	454	0	275	720	15	744	0	0	275	0.000	33.166
NOV	0	597	0	123	720	0	720	0	0	123	-229.387	11.115
DEC	0	720	0	24	744	0	744	0	0	24	-224.948	11.115
ANNUAL	3169	4400	0	1191	5424	3177	8760	0	0	1191		

MO	UTILITY-	ELECTRICITY	NATURAL-GAS
	TOTAL(MBTU)	65.204	212.934
JAN	PEAK(KBTU)	123.379	612.756
	DY/HR	31/ 7	15/ 3
	TOTAL(MBTU)	58.609	157.700
FEB	PEAK(KBTU)	123.379	549.754
	DY/HR	28/ 7	3/ 4
	TOTAL(MBTU)	63.128	115.464
MAR	PEAK(KBTU)	123.379	448.528
	DY/HR	31/ 7	3/ 4
	TOTAL(MBTU)	58.044	28.567
APR	PEAK(KBTU)	123.379	307.923
	DY/HR	5/ 7	5/ 4
	TOTAL(MBTU)	83.517	5.462
MAY	PEAK(KBTU)	274.696	179.894
	DY/HR	31/18	5/ 4
	TOTAL(MBTU)	115.606	0.000
JUN	PEAK(KBTU)	274.771	0.000
	DY/HR	28/18	30/ 1
	TOTAL(MBTU)	130.490	0.000
JUL	PEAK(KBTU)	293.524	0.000
	DY/HR	23/18	31/ 1
	TOTAL(MBTU)	130.454	0.000
AUG	PEAK(KBTU)	288.456	0.000
	DY/HR	21/19	31/ 1
	TOTAL(MBTU)	98.418	0.000
SEP	PEAK(KBTU)	275.201	0.000
	DY/HR	6/18	30/ 1
	TOTAL(MBTU)	60.807	25.493
OCT	PEAK(KBTU)	230.853	346.224
	DY/HR	1/18	20/ 3
	TOTAL(MBTU)	60.494	95.322
NOV	PEAK(KBTU)	123.379	438.647
	DY/HR	30/19	3/ 4
	TOTAL(MBTU)	65.021	191.874
DEC	PEAK(KBTU)	123.379	528.705
	DY/HR	31/19	15/ 2
	ONE YEAR	989.793	832.816
	USE/PEAK	293.524	612.756

ENERGY TYPE IN SITE MBTU - CATEGORY OF USE	ELECTRICITY	NATURAL-GAS
SPACE HEAT	29.98	832.82
SPACE COOL	270.10	0.00
HVAC AUX	332.47	0.00
DOM HOT WTR	0.00	0.00
AUX SOLAR	0.00	0.00
LIGHTS	283.98	0.00
VERT TRANS	0.00	0.00
MISC EQUIP	73.28	0.00
TOTAL	989.81	832.82

TOTAL SITE ENERGY 1822.61 MBTU 247.9 KBTU/SQFT-YR GROSS-AREA 247.9 KBTU/SQFT-YR NET-AREA
TOTAL SOURCE ENERGY 3805.17 MBTU 517.5 KBTU/SQFT-YR GROSS-AREA 517.5 KBTU/SQFT-YR NET-AREA
PERCENT OF HOURS ANY SYSTEM ZONE OUTSIDE OF THROTTLING RANGE = 0.3
PERCENT OF HOURS ANY PLANT LOAD NOT SATISFIED = 0.0
NOTE ELECTRICITY AND/OR FUEL USED TO GENERATE ELECTRICITY IS APPORTIONED BASED ON THE YEARLY DEMAND. ALL OTHER ENERGY TYPES ARE APPORTIONED HOURLY.

EMC ENGINEERS INC. EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 3/ 6/1995 12: 5:16 SDL RUN 1
DENVER, CO 80227 PROPOSED MODIFICATION OF BLDG. 7245 DINING AREA
REPORT- SS-A SYSTEM MONTHLY LOADS SUMMARY FOR VAV-SPEED TOPEKA, KS

	COOLING						HEATING						ELEC	
MONTH	COOLING ENERGY (MBTU)	TIME OF MAX DY	HR	DRY-BULB TEMP	WET-BULB TEMP	MAXIMUM COOLING LOAD (KBTU/HR)	HEATING ENERGY (MBTU)	TIME OF MAX DY	HR	DRY-BULB TEMP	WET-BULB TEMP	MAXIMUM HEATING LOAD (KBTU/HR)	ELEC-TRICAL ENERGY (KWH)	MAXIMUM ELEC LOAD (KW)
JAN	0.00000					0.000	-176.577	15	3	-8.F	-9.F	-531.225	9564.	23.931
FEB	0.00000					0.000	-128.939	3	4	0.F	-1.F	-472.075	8675.	30.359
MAR	0.00000					0.000	-97.346	3	4	16.F	13.F	-368.587	10264.	33.155
APR	0.00000					0.000	-24.256	5	4	32.F	29.F	-241.324	13782.	33.155
MAY	46.51511	31	18	90.F	76.F	442.531	-4.302	5	4	45.F	41.F	-135.301	13048.	33.155
JUN	115.57044	28	18	89.F	76.F	454.860	0.000					0.000	10158.	29.107
JUL	146.65900	23	18	95.F	79.F	518.667	0.000					0.000	10661.	29.805
AUG	144.33791	21	19	95.F	76.F	475.771	0.000					0.000	10664.	29.440
SEP	75.50708	6	18	91.F	75.F	441.305	0.000					0.000	9779.	28.828
OCT	1.62142	1	18	83.F	68.F	220.962	-23.425	20	3	25.F	25.F	-276.908	13934.	33.155
NOV	0.00000					0.000	-80.243	3	4	13.F	12.F	-363.117	10742.	33.155
DEC	0.00000					0.000	-157.569	15	2	3.F	2.F	-450.325	9560.	22.956
TOTAL	530.210						-692.657						130833.	
MAX						518.667						-531.225		33.155

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EMC ENGINEERS INC. EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 3/ 6/1995 12: 5:16 SDL RUN 1
DENVER, CO 80227 PROPOSED MODIFICATION OF BLDG. 7245 DINING AREA
REPORT- SS-C SYSTEM MONTHLY LOAD HOURS FOR VAV-SPEED TOPEKA, KS

	NUMBER OF HOURS										--COINCIDENT LOADS--	
MONTH	HOURS COOLING LOAD	HOURS HEATING LOAD	HOURS COINCIDENT COOL-HEAT LOAD	HOURS FLOATING	HOURS HEATING AVAIL.	HOURS COOLING AVAIL.	HOURS FANS ON	HOURS FANS CYCLE ON	HOURS NIGHT VENTING	HOURS FLOATING WHEN FANS ON	HEATING LOAD AT COOLING PEAK (KBTU/HR)	ELECTRIC LOAD AT COOLING PEAK (KW)
JAN	0	742	0	2	744	0	744	0	0	2	-230.204	0.905
FEB	0	662	0	10	672	0	672	0	0	10	-231.760	0.905
MAR	0	662	0	82	744	0	744	0	0	82	-223.600	0.905
APR	0	455	0	265	720	0	720	0	0	265	-13.155	10.494
MAY	380	192	0	172	360	384	744	0	0	172	0.000	28.465
JUN	714	0	0	6	0	720	720	0	0	6	0.000	28.750
JUL	744	0	0	0	0	744	744	0	0	0	0.000	29.510
AUG	744	0	0	0	0	744	744	0	0	0	0.000	29.440
SEP	612	0	0	108	0	720	720	0	0	108	0.000	28.764
OCT	17	482	0	245	720	24	744	0	0	245	0.000	24.599
NOV	0	617	0	103	720	0	720	0	0	103	-277.368	0.905
DEC	0	742	0	2	744	0	744	0	0	2	-271.582	0.905
ANNUAL	3211	4554	0	995	5424	3336	8760	0	0	995		

MO	UTILITY-	ELECTRICITY	NATURAL-GAS
	TOTAL(MBTU)	40.835	269.527
JAN	PEAK(KBTU)	90.187	713.594
	DY/HR	31/ 7	15/ 3
	TOTAL(MBTU)	36.755	204.942
FEB	PEAK(KBTU)	103.659	646.978
	DY/HR	26/18	3/ 4
	TOTAL(MBTU)	41.200	160.197
MAR	PEAK(KBTU)	114.590	527.115
	DY/HR	7/19	3/ 4
	TOTAL(MBTU)	49.121	44.838
APR	PEAK(KBTU)	114.365	373.939
	DY/HR	3/19	5/ 4
	TOTAL(MBTU)	64.394	9.250
MAY	PEAK(KBTU)	245.846	241.462
	DY/HR	31/18	5/ 4
	TOTAL(MBTU)	81.558	0.000
JUN	PEAK(KBTU)	247.935	0.000
	DY/HR	28/19	30/ 1
	TOTAL(MBTU)	94.585	0.000
JUL	PEAK(KBTU)	269.717	0.000
	DY/HR	23/18	31/ 1
	TOTAL(MBTU)	95.336	0.000
AUG	PEAK(KBTU)	264.432	0.000
	DY/HR	21/19	31/ 1
	TOTAL(MBTU)	65.677	0.000
SEP	PEAK(KBTU)	248.220	0.000
	DY/HR	6/18	30/ 1
	TOTAL(MBTU)	50.466	44.248
OCT	PEAK(KBTU)	174.332	417.411
	DY/HR	1/18	20/ 3
	TOTAL(MBTU)	41.896	133.389
NOV	PEAK(KBTU)	113.933	520.663
	DY/HR	7/19	3/ 4
	TOTAL(MBTU)	40.646	245.676
DEC	PEAK(KBTU)	90.187	622.136
	DY/HR	31/19	15/ 2
	ONE YEAR	702.468	1112.067
	USE/PEAK	269.717	713.594

ENERGY TYPE IN SITE MBTU - CATEGORY OF USE	ELECTRICITY	NATURAL-GAS
SPACE HEAT	39.34	1112.07
SPACE COOL	216.41	0.00
HVAC AUX	89.46	0.00
DOM HOT WTR	0.00	0.00
AUX SOLAR	0.00	0.00
LIGHTS	283.97	0.00
VERT TRANS	0.00	0.00
MISC EQUIP	73.28	0.00
TOTAL	702.46	1112.07

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TOTAL SITE ENERGY        1814.53 MBTU     246.8 KBTU/SQFT-YR GROSS-AREA     246.8 KBTU/SQFT-YR NET-AREA
TOTAL SOURCE ENERGY      3221.58 MBTU     438.1 KBTU/SQFT-YR GROSS-AREA     438.1 KBTU/SQFT-YR NET-AREA
PERCENT OF HOURS ANY SYSTEM ZONE OUTSIDE OF THROTTLING RANGE = 13.7
PERCENT OF HOURS ANY PLANT LOAD NOT SATISFIED                =  0.0
NOTE   ELECTRICITY AND/OR FUEL USED TO GENERATE ELECTRICITY IS APPORTIONED BASED
       ON THE YEARLY DEMAND.  ALL OTHER ENERGY TYPES ARE APPORTIONED HOURLY.
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BUILDING 7245B
ANNUAL ENERGY SAVINGS SUMMARY

Item	Baseline	ECO	Annual Energy Savings	Adj. Annual Energy Savings*
Annual Electric (MBTU)	1011.71	908.39	103.32	103.32
Annual Natural Gas (MBTU)	4317.23	806.35	3510.88	3510.88
Electric Demand June (KW)	50.44	44.27	6.16	6.16
Electric Demand July (KW)	49.07	44.06	5.01	5.01
Electric Demand August (KW)	50.44	44.06	6.37	6.37

*Energy savings prorated on a square foot basis:

Baseline Model Bldg 7606B (sq.ft.)	3954.4
ECO Model Bldg 7245B (sq.ft.)	3954.4
Square Footage Adjustment Factor	1.000

LIFE CYCLE COST ANALYSIS SUMMARY

ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

LOCATION:	Fort Riley	REGION: 2 (Kansas)		PROJECT NO:	1406-005
PROJECT TITLE:	Feasibility Study for HVAC Upgrade			FISCAL YEAR:	1995
ANALYSIS DATE:	05/04/95	ECONOMIC LIFE:	20	PREPARED BY:	C. Wohlert

1. INVESTMENT: **BLDG 7245 - Replace Kitchen MAUs & Exhaust w/ Heat Recovery Units**

A.	CONSTRUCTION COST	=	$81,017	
B.	SIOH COST	(5.5% of 1A) =	$4,456	
C.	DESIGN COST	(6.0% of 1A) =	$4,861	
D.	TOTAL COST	(1A +1B +1C) =	$90,334	
E.	SALVAGE VALUE OF EXISTING EQUIPMENT =		$0	
F.	PUBLIC UTILITY COMPANY REBATE =		$0	
G.	TOTAL INVESTMENT	(1D -1E -1F) =	------->	$90,334

2. ENERGY SAVINGS (+) OR COST (-):

DATE OF NISTR 85-3273-9 USED FOR DISCOUNT FACTORS: JAN '95

	ENERGY SOURCE	FUEL COST $/MBTU (1)	SAVINGS MBTU/YR (2)	ANNUAL $ SAVINGS (3)	DISCOUNT FACTOR (4)	DISCOUNTED SAVINGS (5)	
A.	ELECT.	$12.10	103	$1,250	15.88	$19,853	
B.	DIST	$0.00	0	$0	19.16	$0	
C.	NAT GAS	$4.12	3,511	$14,465	18.30	$264,706	
D.	COAL	$0.00	0	$0	16.62	$0	
E.	ELEC. DEMAND			$332	14.88	$4,942	
F.	TOTAL		3,614	$16,047		-------->	$289,501

3. NON-ENERGY SAVINGS (+) OR COST (-)

A. ANNUAL RECURRING (+/-)

1 ANNUAL MAINTENANCE	$0	14.88	$0
2	$0	14.88	$0
3	$0	14.88	$0
4 TOTAL ANNUAL DISC. SAVINGS (+) / COST (-	$0		$0

B. NON-RECURRING (+/-)

ITEM	SAVINGS (+) COST(-) (1)	YEAR OF OCCURRENCE (2)	DISCOUNT FACTOR (3) (TABLE A-2)	DISCOUNTED SAVINGS/COST (4)
a. BASELINE EQUIP. REPLCMNT.	$30,377	5	0.863	$26,215
b.				$0
c.				$0
d. TOTAL	$30,377			$26,215

C. TOTAL NON-ENERGY DISCOUNTED SAVINGS (+) OR COST (-) (3A4 + 3Bd4) = $26,215

4.	FIRST YEAR DOLLAR SAVINGS (+) / COSTS (-)	(2F3+3A4+(3Bd1/Economic Life))	$17,566
5.	SIMPLE PAYBACK (SPB) IN YEARS (MUST BE < 10 YEARS TO QUALIFY)	(1G/4) =	5.14
6.	TOTAL NET DISCOUNTED SAVINGS	(2F5 + 3C) =	$315,716
7.	DISCOUNTED SAVINGS-TO-INVESTMENT RATIO (SIR) (MUST HAVE SIR > 1.25 TO QUALIFY)	(6/1G) =	3.49

ENGINEER'S OPINION OF PROBABLE COST

PROJECT	Fort Riley Feasibility Study for HVAC Upgrade	**SHEET** 1 **OF** 1	
		DATE PREPARED	4-May-95
ENGINEER	E M C Engineers, Inc. Denver, CO	**ESTIMATOR**	C. Wohlert
		CHECKED BY	A. Niemeyer

				MATERIAL COST			LABOR COST			
Line No.	Item Refer Code	Item Description	Unit of Measure	Quantity	Unit Cost	Total	Crew/ Worker	Hours/ Unit	Total	TOTAL
1		**BUILDING 7245**								
2		**PROPOSED SYSTEM MODIFICATIONS**								
3										
4		*NEW SYSTEMS INSTALLATION*								
5	KHRU9C	KITCHEN HEAT RECOVERY UNIT, 19,000 CFM	EA.	1.0	$28,294.80	$28,295	Q-6	40	$804	$29,099
6	KHRU5	KITCHEN HEAT RECOVERY UNIT, 8,500 CFM	EA.	1.0	$17,442.00	$17,442	Q-6	32	$643	$18,085
7	DUCT1000	GAL. STEEL DUCTWORK, 500 TO 1000 LB.	LB.	950.0	$0.47	$442	Q-10	0.094	$1,735	$2,177
8	STLPIP2	STEEL PIPE SCH. 40, 2" W/HANGERS	L.F.	50.0	$3.91	$196	Q-1	0.25	$242	$438
9		FITTINGS, 5%				$10			$12	$22
10	INSLPIP2	2" FIBERGLASS PIPE INSULATION, 1.5" THCK	L.F.	50.0	$1.46	$73	Q-14	0.084	$77	$151
11	DTINSL2"	DUCT INSLULATION, 2" THICK	S.F.	700.0	$0.83	$583	Q-14	0.053	$683	$1,267
12										
13										
14										
15										
16										
17										
18										
19										
20										
21										
22										
23		*EXISTING SYSTEM DEMOLITION*								
24		AHU DEMOLITION	TON	3.6			Q-5	17.778	$1,241	$1,241
25		DUCT DEMOLITION	TON	0.2			Q-5	17.778	$69	$69
26										
27										
28										
29										
30										
31		**SUBTOTAL**				$47,041			$5,508	$52,548
32	OH	OVERHEAD			17%	$7,903			$925	$8,828
33	PRO	PROFIT			10%	$5,494			$643	$6,138
34	CONT	CONTINGENCY			20%	$12,088			$1,415	$13,503
35	**TOTAL COST**		-	-	-	$72,525	-	-	$8,491	$81,017

ENGINEER'S OPINION OF PROBABLE COST

PROJECT	Fort Riley Feasibility Study for HVAC Upgrade	**SHEET** 1 **OF** 1	
ENGINEER	E M C Engineers, Inc.	**DATE PREPARED**	4-May-95
	Denver, CO	**ESTIMATOR**	C. Wohlert
		CHECKED BY	A. Niemeyer

Line No.	Item Refer Code	Item Description	Unit of Measure	MATERIAL COST Quantity	MATERIAL COST Unit Cost	MATERIAL COST Total	LABOR COST Crew/ Worker	LABOR COST Hours/ Unit	LABOR COST Total	TOTAL
1		**BUILDING 7245**								
2		**NON-RECURRING**								
3		NEW SYSTEMS INSTALLATION								
4										
5	AHU12000	12,000 CFM AHU, HEATING ONLY	EA.	1.0	$5,499.08	$5,499	Q-6	52.174	$1,049	$6,548
6	AHU3200	3,200 CFM AHU, HEATING ONLY	EA.	1.0	$2,519.40	$2,519	Q-5	20	$388	$2,907
7	AHU1300	1,300 CFM AHU, HEATING ONLY	EA.	1.0	$1,913.78	$1,914	Q-5	13.33	$258	$2,172
8	STLPIP1.5	STEEL PIPE SCH. 40, 1.5" W/HANGERS	L.F.	90.0	$2.95	$265	Q-1	0.2	$349	$614
9		FITTINGS, 5%				$13			$17	$31
10	CNTV1.5	CONTROL VALVE 1-1/2"	EA.	3.0	$276.17	$828	1-PLUM	0.727	$47	$875
11	INSLPIP1.5	1.25" FIBERGLASS PIPE INSULATION, 1.5" THCK	L.F.	90.0	$1.40	$126	Q-14	0.08	$133	$258
12	DUCT1000	GAL. STEEL DUCTWORK, 500 TO 1000 LB.	LB.	450.0	$0.47	$209	Q-10	0.094	$822	$1,031
13	DTINSL2"	DUCT INSLULATION, 2" THICK	S.F.	700.0	$0.83	$583	Q-14	0.053	$683	$1,267
14	EXHOD1.3	ROOF EXHAUSTER, 1,300 CFM	EA.	1.0	$479.66	$480	Q-20	4	$77	$556
15	EXHOD11	ROOF EXHAUSTER, 11,000 CFM	EA.	1.0	$1,986.45	$1,986	Q-20	10	$192	$2,178
16	EXHOD3.6	ROOF EXHAUSTER, 3,600 CFM	EA.	1.0	$823.65	$824	Q-20	5	$96	$920
17										
18										
19										
20										
21										
22		*EXISTING SYSTEM DEMOLITION*								
23		AHU DEMOLITION	TON	1.0			Q-5	17.778	$345	$345
24										
25										
26										
27										
28										
29										
30										
31		**SUBTOTAL**				$15,247			$4,455	$19,703
32	OH	OVERHEAD			17%	$2,562			$749	$3,310
33	PRO	PROFIT			10%	$1,781			$520	$2,301
34	CONT	CONTINGENCY			20%	$3,918			$1,145	$5,063
35	**TOTAL COST**		-	-	-	$23,507	-	-	$6,869	$30,377

ENGINEER'S OPINION OF PROBABLE COST

PROJECT	Fort Riley Feasibility Study for HVAC Upgrade	**SHEET** 1 **OF** 1	
		DATE PREPARED	1-Mar-95
ENGINEER	E M C Engineers, Inc. Denver, CO	**ESTIMATOR**	C. Wohlert
		CHECKED BY	A. Niemeyer

Line No.	Item Refer Code	Item Description	Unit of Measure	MATERIAL COST			LABOR COST			TOTAL
				Quantity	Unit Cost	Total	Crew/ Worker	Hours/ Unit	Total	
1		**BUILDING 7245**								
2		***ANNUAL RECURRING***								
3		***ANNUAL MAINTENANCE COST - BASELINE***								
4										
5										
6										
7										
8										
9										
10										
11										
12										
13										
14										
15	**TOTAL ANNUAL MAINTENANCE COST - BASELINE**		-	-	-	$0	-	-	$0	$0
16										
17		***ANNUAL MAINTENANCE COST - NEW HVAC REPLACEMENT***								
18										
19										
20										
21										
22										
23										
24										
25										
26										
27										
28										
29	**TOTAL ANNUAL MAINTENANCE COST - BASELINE**		-	-	-	$0	-	-	$0	$0
30										
31										
32										
33										
34										
35	**TOTAL ANNUAL MAINTENANCE COST SAVINGS**		-	-	-	$0	-	-	$0	$0

DEMAND LIMITING ANALYSIS BUILDING 7245B

SUMMER PEAK (KW) = 27812	1993 JUL BILL 7/1-8/2 ACTUAL	1993 AUG BILL 8/2-9/1 ACTUAL	1993 SEP BILL 9/3-10/1 ACTUAL	1993 OCT BILL 10/1-11/1 ACTUAL	1993 NOV BILL 11/1-12/1 ACTUAL	1993 DEC BILL 12/1-1/3 ACTUAL	1993 JAN BILL 1/4-2/1 ACTUAL	1993 FEB BILL 2/1-3/1 ACTUAL	1993 MAR BILL 3/3-4/1 ACTUAL	1993 APR BILL 4/1-5/3 ACTUAL	1993 MAY BILL 5/3-6/1 ACTUAL	1993 JUN BILL 6/1-7/1 ACTUAL
BASE CASE												
CAPACITY (KW)	32472	34452	26136	20754	26400	22752	27108	25812	23310	21834	21996	30096
POWER FACTOR (%)	99.20%	99.10%	99.10%	99.90%	99.80%	99.70%	99.50%	99.60%	99.60%	99.80%	99.60%	98.80%
CAPACITY (KVA)	32734	34765	26373	20775	26453	22820	27244	25916	23404	21878	22084	30462
80% SUMMER PEAK (KVA)	27812	27812	27812	27812	27812	27812	27812	27812	27812	27812	27812	27812
CONTRACT MINIMUM (KVA)	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643
BILLING CAPACITY (KVA)	32734	34765	27812	27812	27812	27812	27812	27812	27812	27812	27812	30462
ACTUAL OR 80% PEAK	ACTUAL	ACTUAL	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	ACTUAL
200 KVA @ $4.45	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00
NEXT 400 @ $4.25	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00
REMAINING @ $4.05	$130,142.18	$138,367.78	$110,208.22	$110,208.22	$110,208.22	$110,208.22	$110,208.22	$110,208.22	$110,208.22	$110,208.22	$110,208.22	$120,939.23
SUB DISCOUNT $.20	($6,546.77)	($6,952.98)	($5,562.38)	($5,562.38)	($5,562.38)	($5,562.38)	($5,562.38)	($5,562.38)	($5,562.38)	($5,562.38)	($5,562.38)	($6,092.31)
CAPACITY CHARGE	$126,185.40	$134,004.80	$107,235.84	$107,235.84	$107,235.84	$107,235.84	$107,235.84	$107,235.84	$107,235.84	$107,235.84	$107,235.84	$117,436.92
TOTAL ENERGY (KWH)	16,920,000	16,200,000	10,980,000	10,140,000	11,160,000	12,930,000	12,600,000	12,270,000	12,480,000	11,070,000	9,720,000	13,170,000
50*KVA @ $.03924	$64,223.85	$68,208.70	$54,566.96	$54,566.96	$54,566.96	$54,566.96	$54,566.96	$54,566.96	$54,566.96	$54,566.96	$54,566.96	$59,765.54
100*KVA @ $.03404	$111,426.10	$118,339.66	$94,671.73	$94,671.73	$94,671.73	$94,671.73	$94,671.73	$94,671.73	$94,671.73	$94,671.73	$94,671.73	$103,691.08
250*KVA @ $.03084	$252,378.15	$268,037.26	$209,965.32	$184,059.72	$214,429.80	$214,429.80	$214,429.80	$214,429.80	$214,429.80	$212,740.92	$171,106.92	$234,858.46
EXCESS @ $.02864	$109,589.57	$65,701.49	$0.00	$0.00	$1,009.19	$51,701.99	$42,250.79	$32,799.59	$38,813.99	$0.00	$0.00	$28,221.42
ENERGY CHARGE	$537,617.67	$520,287.11	$359,204.01	$333,298.41	$364,677.69	$415,370.49	$405,919.29	$396,468.09	$402,482.49	$361,979.61	$320,345.61	$426,536.49
TOTAL CHARGE LESS ECA	$663,803.07	$654,291.92	$466,439.85	$440,534.25	$471,913.53	$522,606.33	$513,155.13	$503,703.93	$509,718.33	$469,215.45	$427,581.45	$543,973.42
DEMAND REDUCTION (KW)	**5.01**	**6.37**	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**6.16**
CAPACITY (KW)	32467	34446	26136	20754	26400	22752	27108	25812	23310	21834	21996	30090
POWER FACTOR (%)	99.20%	99.10%	99.10%	99.90%	99.80%	99.70%	99.50%	99.60%	99.60%	99.80%	99.60%	98.80%
CAPACITY (KVA)	32729	34758	26373	20775	26453	22820	27244	25916	23404	21878	22084	30455
80% SUMMER PEAK (KVA)	27807	27807	27807	27807	27807	27807	27807	27807	27807	27807	27807	27807
CONTRACT MINIMUM (KVA)	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643
BILLING CAPACITY (KVA)	32729	34758	27807	27807	27807	27807	27807	27807	27807	27807	27807	30455
ACTUAL OR 80% PEAK	ACTUAL	ACTUAL	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	ACTUAL
200 KVA @ $4.45	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00
NEXT 400 @ $4.25	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00
REMAINING @ $4.05	$130,121.72	$138,341.74	$110,187.39	$110,187.39	$110,187.39	$110,187.39	$110,187.39	$110,187.39	$110,187.39	$110,187.39	$110,187.39	$120,913.96
SUB DISCOUNT $.20	($6,545.76)	($6,951.69)	($5,561.35)	($5,561.35)	($5,561.35)	($5,561.35)	($5,561.35)	($5,561.35)	($5,561.35)	($5,561.35)	($5,561.35)	($6,091.06)
CAPACITY CHARGE	$126,165.95	$133,980.04	$107,216.04	$107,216.04	$107,216.04	$107,216.04	$107,216.04	$107,216.04	$107,216.04	$107,216.04	$107,216.04	$117,412.90
TOTAL ENERGY (KWH)	16,920,000	16,200,000	10,980,000	10,140,000	11,160,000	12,930,000	12,600,000	12,270,000	12,480,000	11,070,000	9,720,000	13,170,000
50*KVA @ $.03924	$64,213.94	$68,196.08	$54,556.87	$54,556.87	$54,556.87	$54,556.87	$54,556.87	$54,556.87	$54,556.87	$54,556.87	$54,556.87	$59,753.30
100*KVA @ $.03404	$111,408.90	$118,317.77	$94,654.22	$94,654.22	$94,654.22	$94,654.22	$94,654.22	$94,654.22	$94,654.22	$94,654.22	$94,654.22	$103,669.84
250*KVA @ $.03084	$252,339.19	$267,987.67	$209,989.12	$184,083.52	$214,390.14	$214,390.14	$214,390.14	$214,390.14	$214,390.14	$212,764.72	$171,130.72	$234,810.36
EXCESS @ $.02864	$109,647.45	$65,775.16	$0.00	$0.00	$1,068.13	$51,760.93	$42,309.73	$32,858.53	$38,872.93	$0.00	$0.00	$28,292.89
ENERGY CHARGE	$537,609.49	$520,276.69	$359,200.20	$333,294.60	$364,669.36	$415,362.16	$405,910.96	$396,459.76	$402,474.16	$361,975.80	$320,341.80	$426,526.39
TOTAL CHARGE LESS ECA	$663,775.44	$654,256.74	$466,416.24	$440,510.64	$471,885.39	$522,578.19	$513,126.99	$503,675.79	$509,690.19	$469,191.84	$427,557.84	$543,939.29
SUMMARY												
MONTHLY DIFFERENCE	$27.64	$35.18	$23.61	$23.61	$28.14	$28.14	$28.14	$28.14	$28.14	$23.61	$23.61	$34.13
ANNUAL DIFFERENCE.............		**$332.10**										

NUMBER OF EXTERIOR SURFACES 7 RECTANGULAR 7 OTHER 0
(U-VALUE INCLUDES INSIDE AIR FILM PLUS OUTSIDE AIR FILM AT 7.5 MPH WINDSPEED)

SURFACE	SPACE	- - - - G L A S S - - - - U-VALUE (BTU/HR-SQFT-F)	AREA (SQFT)	- - - - W A L L - - - - U-VALUE (BTU/HR-SQFT-F)	AREA (SQFT)	- W A L L + G L A S S - U-VALUE (BTU/HR-SQFT-F)	AREA (SQFT)	AZIMUTH
	KITCHEN	1.021	42.40	0.082	371.00	0.178	413.40	SOUTH-EAST
	KIT-MEZZIN	0.000	0.00	0.082	351.00	0.082	351.00	SOUTH-EAST
	KIT-MEZZIN	0.000	0.00	0.082	776.70	0.082	776.70	SOUTH-WEST
	KITCHEN	1.021	115.20	0.082	799.58	0.200	914.78	SOUTH-WEST
	KITCHEN	1.021	16.00	0.082	397.40	0.118	413.40	NORTH-WEST
	KIT-MEZZIN	0.000	0.00	0.082	351.00	0.082	351.00	NORTH-WEST
	KIT-MEZZIN	0.000	0.00	0.077	3960.00	0.077	3960.00	ROOF
	KITCHEN	0.000	0.00	0.020	3960.00	0.020	3960.00	UNDERGRND

EMC ENGINEERS INC. EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/ 8/1995 17: 7: 5 LDL RUN 1
DENVER, CO 80227 EXISTING CONDITION OF BULIDING 7245 KITCHEN AREA
REPORT- LV-D DETAILS OF EXTERIOR SURFACES IN THE PROJECT TOPEKA, KS

	AVERAGE U-VALUE/GLASS (BTU/HR-SQFT-F)	AVERAGE U-VALUE/WALLS (BTU/HR-SQFT-F)	AVERAGE U-VALUE WALLS+GLASS (BTU/HR-SQFT-F)	GLASS AREA (SQFT)	OPAQUE AREA (SQFT)	GLASS+OPAQUE AREA (SQFT)
SOUTH-EAST	1.021	0.082	0.134	42.40	722.00	764.40
SOUTH-WEST	1.021	0.082	0.146	115.20	1576.28	1691.48
NORTH-WEST	1.021	0.082	0.101	16.00	748.40	764.40
ROOF	0.000	0.077	0.077	0.00	3960.00	3960.00
ALL WALLS	1.021	0.082	0.132	173.60	3046.68	3220.28
WALLS+ROOFS	1.021	0.079	0.102	173.60	7006.68	7180.28
UNDERGRND	0.000	0.020	0.020	0.00	3960.00	3960.00
BUILDING	1.021	0.058	0.073	173.60	10966.68	11140.28

*** BUILDING ***

FLOOR AREA	3954	SQFT	367	SQMT
VOLUME	41917	CUFT	1187	CUMT

	COOLING LOAD				HEATING LOAD	
TIME	AUG 24	6PM			JAN 28	4AM
DRY-BULB TEMP	93F	34C			0F	-18C
WET-BULB TEMP	76F	24C			-2F	-19C
	SENSIBLE		LATENT		SENSIBLE	
	(KBTU/H)	(KW)	(KBTU/H)	(KW)	(KBTU/H)	(KW)
WALLS	1.904	0.558	0.000	0.000	-8.554	-2.505
ROOFS	0.000	0.000	0.000	0.000	0.000	0.000
GLASS CONDUCTION	3.276	0.960	0.000	0.000	-13.951	-4.086
GLASS SOLAR	14.150	4.144	0.000	0.000	0.282	0.082
DOOR	0.019	0.005	0.000	0.000	-0.040	-0.012
INTERNAL SURFACES	0.000	0.000	0.000	0.000	0.000	0.000
UNDERGROUND SURFACES	-0.375	-0.110	0.000	0.000	-2.274	-0.666
OCCUPANTS TO SPACE	7.218	2.114	12.500	3.661	0.771	0.226
LIGHT TO SPACE	8.504	2.491	0.000	0.000	3.254	0.953
EQUIPMENT TO SPACE	72.879	21.344	0.000	0.000	7.136	2.090
PROCESS TO SPACE	0.000	0.000	0.000	0.000	0.000	0.000
INFILTRATION	0.000	0.000	0.000	0.000	0.000	0.000
TOTAL	107.575	31.506	12.500	3.661	-13.376	-3.918
TOTAL LOAD	120.075 KBTU/H		35.167	KW	-13.376 KBTU/H	-3.918 KW
TOTAL LOAD / AREA	30.37BTU/H.SQFT		95.725	W /SQMT	3.383BTU/H.SQFT	10.664 W /SQMT

NOTE 1)THE ABOVE LOADS EXCLUDE OUTSIDE VENTILATION AIR LOADS
2)TIMES GIVEN IN STANDARD TIME FOR THE LOCATION IN CONSIDERATION

EMC ENGINEERS INC. EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/ 8/1995 17: 7: 5 SDL RUN 1
DENVER, CO 80227 EXISTING CONDITION OF BULIDING 7245 KITCHEN AREA
REPORT- SS-A SYSTEM MONTHLY LOADS SUMMARY FOR KIT_H&VS TOPEKA, KS

	COOLING						HEATING						ELEC	
MONTH	COOLING ENERGY (MBTU)	TIME OF MAX DY	HR	DRY-BULB TEMP	WET-BULB TEMP	MAXIMUM COOLING LOAD (KBTU/HR)	HEATING ENERGY (MBTU)	TIME OF MAX DY	HR	DRY-BULB TEMP	WET-BULB TEMP	MAXIMUM HEATING LOAD (KBTU/HR)	ELEC-TRICAL ENERGY (KWH)	MAXIMUM ELEC LOAD (KW)
JAN	0.00000					0.000	-558.169	15	3	-8.F	-9.F	-1095.280	21944.	43.289
FEB	0.00000					0.000	-466.424	3	7	-5.F	-6.F	-1040.075	19821.	43.289
MAR	0.00000					0.000	-407.669	4	4	14.F	12.F	-939.315	21944.	43.289
APR	0.00000					0.000	-185.857	5	7	30.F	27.F	-745.109	21236.	43.289
MAY	0.00000					0.000	-94.246	1	6	37.F	37.F	-606.853	21944.	43.289
JUN	0.00000					0.000	-30.668	2	7	50.F	49.F	-370.723	21236.	43.289
JUL	0.00000					0.000	-9.397	29	7	59.F	58.F	-212.567	21944.	43.289
AUG	0.00000					0.000	-12.899	4	7	54.F	53.F	-298.524	21944.	43.289
SEP	0.00000					0.000	-87.143	11	7	40.F	40.F	-559.145	21236.	43.289
OCT	0.00000					0.000	-181.693	20	8	23.F	22.F	-886.345	21944.	43.289
NOV	0.00000					0.000	-346.989	2	24	15.F	14.F	-939.312	21236.	43.289
DEC	0.00000					0.000	-534.212	11	22	15.F	13.F	-944.996	21944.	43.289
TOTAL	0.000						-2915.363						258360.	
MAX						0.000						-1095.280		43.289

D7-23

EMC ENGINEERS INC. EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/ 8/1995 17: 7: 5 SDL RUN 1
DENVER, CO 80227 EXISTING CONDITION OF BULIDING 7245 KITCHEN AREA
REPORT- SS-C SYSTEM MONTHLY LOAD HOURS FOR KIT_H&VS TOPEKA, KS

	NUMBER OF HOURS										COINCIDENT LOADS	
MONTH	HOURS COOLING LOAD	HOURS HEATING LOAD	HOURS COINCIDENT COOL-HEAT LOAD	HOURS FLOATING	HOURS HEATING AVAIL.	HOURS COOLING AVAIL.	HOURS FANS ON	HOURS FANS CYCLE ON	HOURS NIGHT VENTING	HOURS FLOATING WHEN FANS ON	HEATING LOAD AT COOLING PEAK (KBTU/HR)	ELECTRIC LOAD AT COOLING PEAK (KW)
JAN	0	744	0	0	744	0	744	0	0	0	-703.653	23.485
FEB	0	672	0	0	672	0	672	0	0	0	-720.720	23.485
MAR	0	744	0	0	744	0	744	0	0	0	-701.250	23.485
APR	0	663	0	57	720	0	720	0	0	57	-388.244	16.222
MAY	0	508	0	236	744	0	744	0	0	236	-158.677	16.222
JUN	0	289	0	431	720	0	720	0	0	431	0.000	16.222
JUL	0	148	0	596	744	0	744	0	0	596	-26.091	16.222
AUG	0	159	0	585	744	0	744	0	0	585	0.000	16.222
SEP	0	421	0	299	720	0	720	0	0	299	-406.486	16.222
OCT	0	652	0	92	744	0	744	0	0	92	-528.265	23.485
NOV	0	708	0	12	720	0	720	0	0	12	-826.303	23.485
DEC	0	744	0	0	744	0	744	0	0	0	-777.474	23.485
ANNUAL	0	6452	0	2308	8760	0	8760	0	0	2308		

REPORT- PS-B MONTHLY PEAK AND TOTAL ENERGY USE TOPEKA, KS

MO	UTILITY-	ELECTRICITY	NATURAL-GAS
	TOTAL(MBTU)	93.032	779.680
JAN	PEAK(KBTU)	172.143	1438.102
	DY/HR	31/18	15/ 3
	TOTAL(MBTU)	84.000	660.615
FEB	PEAK(KBTU)	172.143	1377.675
	DY/HR	28/18	3/ 7
	TOTAL(MBTU)	92.337	598.309
MAR	PEAK(KBTU)	172.143	1265.917
	DY/HR	31/18	4/ 4
	TOTAL(MBTU)	84.544	301.045
APR	PEAK(KBTU)	172.143	1045.171
	DY/HR	30/ 7	5/ 7
	TOTAL(MBTU)	82.762	164.558
MAY	PEAK(KBTU)	172.143	883.734
	DY/HR	28/ 7	1/ 6
	TOTAL(MBTU)	75.418	57.134
JUN	PEAK(KBTU)	172.143	599.770
	DY/HR	12/ 7	2/ 7
	TOTAL(MBTU)	75.896	18.725
JUL	PEAK(KBTU)	167.476	379.872
	DY/HR	29/ 7	29/ 7
	TOTAL(MBTU)	76.205	24.830
AUG	PEAK(KBTU)	172.143	510.869
	DY/HR	4/ 7	4/ 7
	TOTAL(MBTU)	79.157	148.335
SEP	PEAK(KBTU)	172.143	827.201
	DY/HR	30/18	11/ 7
	TOTAL(MBTU)	87.179	297.240
OCT	PEAK(KBTU)	172.143	1206.406
	DY/HR	31/18	20/ 8
	TOTAL(MBTU)	88.116	515.101
NOV	PEAK(KBTU)	172.143	1265.913
	DY/HR	30/18	2/24
	TOTAL(MBTU)	93.024	751.656
DEC	PEAK(KBTU)	172.143	1272.269
	DY/HR	31/18	11/22
	ONE YEAR	1011.671	4317.231
	USE/PEAK	172.143	1438.102

ENERGY TYPE IN SITE MBTU - CATEGORY OF USE	ELECTRICITY	NATURAL-GAS
SPACE HEAT	129.47	4317.23
SPACE COOL	0.00	0.00
HVAC AUX	367.52	0.00
DOM HOT WTR	0.00	0.00
AUX SOLAR	0.00	0.00
LIGHTS	65.32	0.00
VERT TRANS	0.00	0.00
MISC EQUIP	449.40	0.00
TOTAL	1011.71	4317.23

TOTAL SITE ENERGY 5328.90 MBTU 1345.7 KBTU/SQFT-YR GROSS-AREA 1347.6 KBTU/SQFT-YR NET-AREA
TOTAL SOURCE ENERGY 7355.28 MBTU 1857.4 KBTU/SQFT-YR GROSS-AREA 1860.0 KBTU/SQFT-YR NET-AREA
PERCENT OF HOURS ANY SYSTEM ZONE OUTSIDE OF THROTTLING RANGE = 4.9
PERCENT OF HOURS ANY PLANT LOAD NOT SATISFIED = 0.0
NOTE ELECTRICITY AND/OR FUEL USED TO GENERATE ELECTRICITY IS APPORTIONED BASED ON THE YEARLY DEMAND. ALL OTHER ENERGY TYPES ARE APPORTIONED HOURLY.

EMC ENGINEERS INC. EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/ 8/1995 17:15:53 SDL RUN 1
DENVER, CO 80227 PROPOSED MODIFICATION OF BULIDING 7245 KITCHEN AREA
REPORT- SS-A SYSTEM MONTHLY LOADS SUMMARY FOR KIT_H&VS TOPEKA, KS

	- - - - C O O L I N G - - - -								- - - - H E A T I N G - - - -							- - E L E C - -	
MONTH	COOLING ENERGY (MBTU)	TIME OF MAX DY	HR	DRY-BULB TEMP	WET-BULB TEMP	MAXIMUM COOLING LOAD (KBTU/HR)	HEATING ENERGY (MBTU)	TIME OF MAX DY	HR	DRY-BULB TEMP	WET-BULB TEMP	MAXIMUM HEATING LOAD (KBTU/HR)	ELEC-TRICAL ENERGY (KWH)	MAXIMUM ELEC LOAD (KW)
JAN	0.00000					0.000	-122.144	16	10	19.F	16.F	-294.581	21944.	43.289
FEB	0.00000					0.000	-96.293	3	11	16.F	13.F	-277.715	19821.	43.289
MAR	0.00000					0.000	-74.915	3	4	16.F	13.F	-246.204	21944.	43.289
APR	0.00000					0.000	-24.267	5	4	32.F	29.F	-165.388	21236.	43.289
MAY	0.00000					0.000	-7.285	1	4	39.F	37.F	-116.566	21944.	43.289
JUN	0.00000					0.000	-2.499	23	4	67.F	66.F	-75.891	21236.	43.289
JUL	0.00000					0.000	-1.333	4	4	68.F	65.F	-59.244	21944.	43.289
AUG	0.00000					0.000	-0.844	26	10	69.F	67.F	-42.436	21944.	43.289
SEP	0.00000					0.000	-8.166	11	4	43.F	42.F	-91.949	21236.	43.289
OCT	0.00000					0.000	-20.983	20	4	25.F	25.F	-197.680	21944.	43.289
NOV	0.00000					0.000	-60.738	2	4	17.F	15.F	-240.878	21236.	43.289
DEC	0.00000					0.000	-113.182	15	9	16.F	14.F	-273.544	21944.	43.289
TOTAL	0.000						-532.649						258360.	
MAX						0.000						-294.581		43.289

EMC ENGINEERS INC. EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/ 8/1995 17:15:53 SDL RUN 1
DENVER, CO 80227 PROPOSED MODIFICATION OF BULIDING 7245 KITCHEN AREA
REPORT- SS-C SYSTEM MONTHLY LOAD HOURS FOR KIT_H&VS TOPEKA, KS

	- - - - N U M B E R O F H O U R S - - - -										--COINCIDENT LOADS--	
MONTH	HOURS COOLING LOAD	HOURS HEATING LOAD	HOURS COINCIDENT COOL-HEAT LOAD	HOURS FLOATING	HOURS HEATING AVAIL.	HOURS COOLING AVAIL.	HOURS FANS ON	HOURS FANS CYCLE ON	HOURS NIGHT VENTING	HOURS FLOATING WHEN FANS ON	HEATING LOAD AT COOLING PEAK (KBTU/HR)	ELECTRIC LOAD AT COOLING PEAK (KW)
JAN	0	744	0	0	744	0	744	0	0	0	-152.729	23.485
FEB	0	669	0	3	672	0	672	0	0	3	-156.009	23.485
MAR	0	689	0	55	744	0	744	0	0	55	-149.142	23.485
APR	0	419	0	301	720	0	720	0	0	301	-58.487	16.222
MAY	0	218	0	526	744	0	744	0	0	526	0.000	16.222
JUN	0	105	0	615	720	0	720	0	0	615	0.000	16.222
JUL	0	52	0	692	744	0	744	0	0	692	-26.091	16.222
AUG	0	46	0	698	744	0	744	0	0	698	0.000	16.222
SEP	0	233	0	487	720	0	720	0	0	487	-68.662	16.222
OCT	0	430	0	314	744	0	744	0	0	314	-97.472	23.485
NOV	0	591	0	129	720	0	720	0	0	129	-183.677	23.485
DEC	0	744	0	0	744	0	744	0	0	0	-176.343	23.485
ANNUAL	0	4940	0	3820	8760	0	8760	0	0	3820		

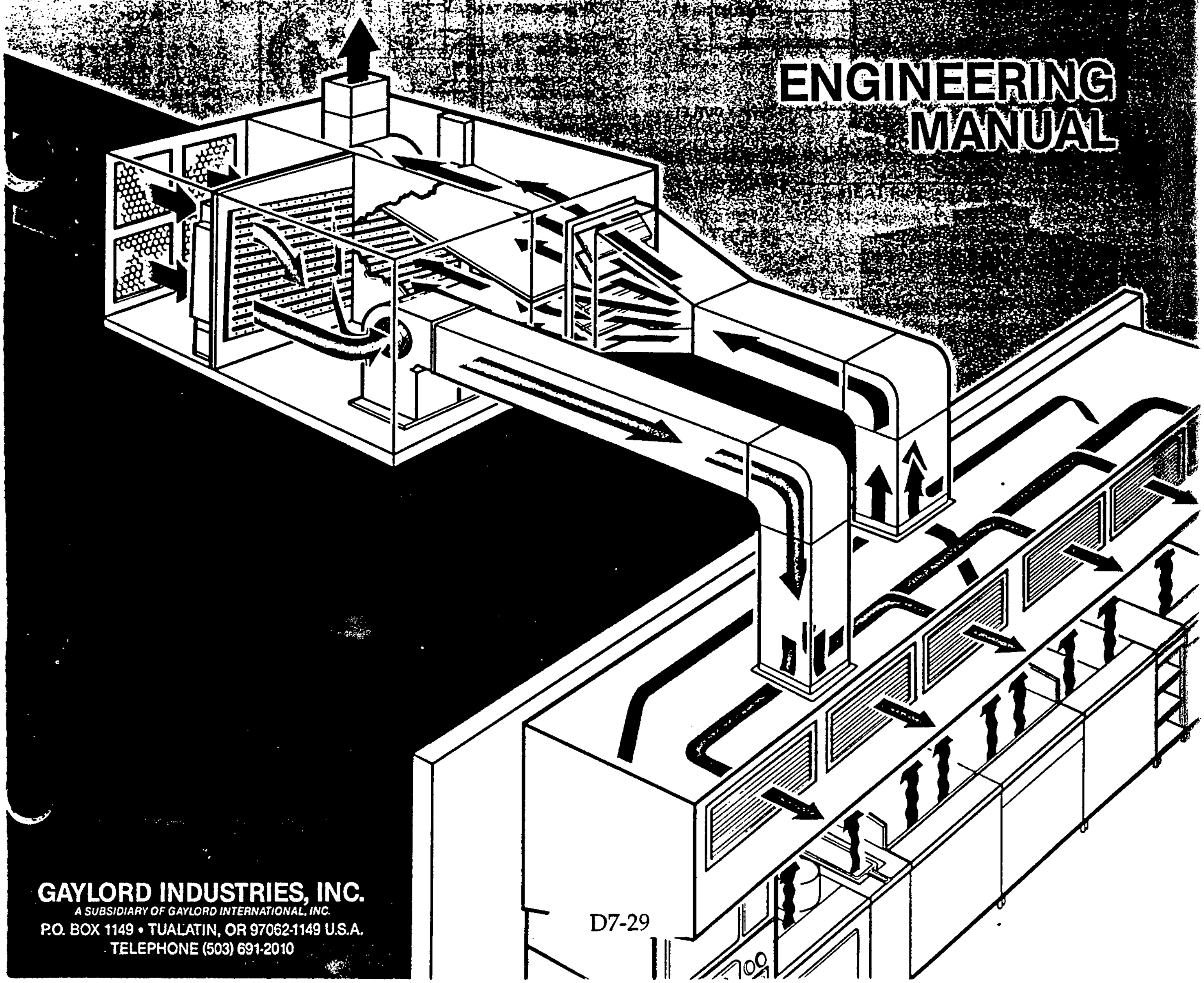
MO	UTILITY-	ELECTRICITY	NATURAL-GAS
	TOTAL(MBTU)	79.674	176.135
JAN	PEAK(KBTU)	154.352	386.785
	DY/HR	31/18	16/10
	TOTAL(MBTU)	71.862	142.049
FEB	PEAK(KBTU)	154.352	368.311
	DY/HR	28/12	3/11
	TOTAL(MBTU)	78.796	114.596
MAR	PEAK(KBTU)	154.352	333.269
	DY/HR	31/12	3/ 4
	TOTAL(MBTU)	74.286	40.820
APR	PEAK(KBTU)	154.352	240.247
	DY/HR	24/ 7	5/ 4
	TOTAL(MBTU)	75.600	13.342
MAY	PEAK(KBTU)	154.352	181.858
	DY/HR	6/ 5	1/ 4
	TOTAL(MBTU)	72.756	4.769
JUN	PEAK(KBTU)	151.106	131.949
	DY/HR	2/ 5	23/ 4
	TOTAL(MBTU)	75.058	2.525
JUL	PEAK(KBTU)	150.371	105.691
	DY/HR	28/ 5	4/ 4
	TOTAL(MBTU)	75.013	1.665
AUG	PEAK(KBTU)	150.392	77.127
	DY/HR	27/ 5	26/10
	TOTAL(MBTU)	73.280	15.001
SEP	PEAK(KBTU)	154.352	151.789
	DY/HR	11/ 7	11/ 4
	TOTAL(MBTU)	76.663	36.615
OCT	PEAK(KBTU)	154.352	277.960
	DY/HR	27/ 7	20/ 4
	TOTAL(MBTU)	75.797	93.941
NOV	PEAK(KBTU)	154.352	327.277
	DY/HR	30/18	2/ 4
	TOTAL(MBTU)	79.562	164.888
DEC	PEAK(KBTU)	154.352	363.713
	DY/HR	31/18	15/ 9
	ONE YEAR	908.349	806.346
	USE/PEAK	154.352	386.785

ENERGY TYPE IN SITE MBTU - CATEGORY OF USE	ELECTRICITY	NATURAL-GAS
SPACE HEAT	26.15	806.35
SPACE COOL	0.00	0.00
HVAC AUX	367.52	0.00
DOM HOT WTR	0.00	0.00
AUX SOLAR	0.00	0.00
LIGHTS	65.32	0.00
VERT TRANS	0.00	0.00
MISC EQUIP	449.40	0.00
TOTAL	908.39	806.35

TOTAL SITE ENERGY 1714.69 MBTU 433.0 KBTU/SQFT-YR GROSS-AREA 433.6 KBTU/SQFT-YR NET-AREA
TOTAL SOURCE ENERGY 3534.12 MBTU 892.5 KBTU/SQFT-YR GROSS-AREA 893.7 KBTU/SQFT-YR NET-AREA
PERCENT OF HOURS ANY SYSTEM ZONE OUTSIDE OF THROTTLING RANGE = 3.3
PERCENT OF HOURS ANY PLANT LOAD NOT SATISFIED = 0.0
NOTE ELECTRICITY AND/OR FUEL USED TO GENERATE ELECTRICITY IS APPORTIONED BASED ON THE YEARLY DEMAND. ALL OTHER ENERGY TYPES ARE APPORTIONED HOURLY.

The
GAYLORD
HRU
Heat Reclaim Unit

ENGINEERING MANUAL



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D7-29

CONTROL CABINET PIPE SIZE

Pipe size to and from the control cabinet is determined by adding the water consumption of the water-wash ventilator to the HRU water consumption. The average water consumption for a Gaylord water-wash ventilator is one GPM per lineal ft. of ventilator and the water consumption for the HRU is shown on the following engineering charts. Once the total GPM has been calculated, refer to the pipe size chart below for the correct control cabinet pipe size. The final pipe size to the HRU is also shown on the engineering charts.

NOTE: If the HRU is used in conjunction with a non-water-wash ventilator, then the control cabinet pipe size would be the same as the HRU pipe size.

CONTROL CABINET PIPE SIZE CHART					
MAX GPM	5	10	20	35	50
REQ'D PIPE SIZE	½"	¾"	1"	1¼"	1½"

GLOSSARY OF TERMS

CFM Cubic Feet per Minute (Air Volume)

BTU (British Thermal Unit) The amount of heat required to raise the temperature of one lb. of water by one degree F.

KWH (Kilowatt Hour) 1000 watts for one hour. Also equals 3412 BTU per hour.

1.08 Conversion factor relating to CFM, temperature rise and BTU.

ΔT (Delta T) Temperature difference between the incoming supply air and the exhaust air. Example: If the incoming air temperature is +10°F, and the exhaust is 110°F, ΔT=100°F.

SRF (Supply Recovery Factor) The efficiency of the Heat Reclaim Coil. Supply recovery factors are derived from performance curves provided by QDT, Ltd. Example: An HRU operating at .65 SRF and 100°F ΔT, the supply temperature would increase by 65°. (.65 SRF × 100° ΔT = 65°)

Engineering Charts

The following engineering charts are used to determine the frame size, exhaust and supply fan wheel size and motor H.P., supply recovery factor, and plumbing data. A step by step method of how to use the charts is described on page 3. Once the frame size has been selected, the exact size and location of the duct collars can be determined by using the drawings and the dimension chart on pages 13 and 14.

NOTE: Capacities and sizes shown are for standard units only. For capacities and sizes not listed please consult factory.

HRU FRAME SIZE - 1

TOTAL AIR CAPACITY RANGE (COMBINED EXHAUST AND SUPPLY)
2500 TO 3500 CFM

OVERALL SIZE

LENGTH: 8'-0"
WIDTH: 6'-0"
HEIGHT: 4'-0"
DOES NOT INCLUDE EXHAUST OUTLET DUCT COLLAR
WEIGHT: 1700 LBS.

COIL DATA

SIZE: 24" x 48"
FACE AREA: 8 SQ. FT.
RANGE: 370-520 FPM

PLUMBING REQUIREMENTS

H.W. REQ'D – 140° MIN. 180° MAX.
WATER PRESS. – 40 PSI MIN. 80 PSI MAX.
AVERAGE WASH CYCLE BETWEEN 5 – 7 MIN.

SUPPLY TO EXHAUST RATIO	80%						90%						100%					
EXHAUST FAN DATA — NEAREST EXHAUST VOLUME (CFM)	1400		1650		1900		1300		1600		1850		1250		1500		1750	
EXTERNAL STATIC PRESSURE	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.
1.5"	13	1.0	13	1.0	13	1.5	12	1.0	12	1.0	13	1.5	12	1.0	12	1.0	13	1.5
2.0"	13	1.5	13	1.5	13	2.0	12	1.0	12	1.5	13	2.0	12	1.0	12	1.5	13	1.5
2.5"	12	1.5	12	1.5	13	2.0	12	1.5	12	1.5	13	2.0	12	1.5	12	1.5	13	2.0
SUPPLY FAN DATA — NEAREST SUPPLY VOLUME (CFM)	1100		1300		1500		1150		1450		1650		1250		1500		1750	
EXTERNAL STATIC PRESSURE	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.
0.5"	8	.75	8	1.0	9	1.0	8	1.0	9	1.0	9	1.0	8	1.0	9	1.0	9	1.5
0.75"	8	.75	8	1.0	9	1.0	8	1.0	9	1.0	9	1.0	8	1.0	9	1.0	9	1.5
1.0"	8	1.0	9	1.0	9	1.0	8	1.0	9	1.0	9	1.0	8	1.0	9	1.0	9	1.5
SUPPLY RECOVERY FACTOR	.67		.64		.63		.64		.61		.58		.62		.58		.56	
PLUMBING DATA — GPM@40 PSI	2.5						3.0						3.0					
H.W. SIZE	1/2"						1/2"						1/2"					
DRAIN SIZE	1½"						1½"						1½"					

HRU FRAME SIZE - 2

TOTAL AIR CAPACITY RANGE (COMBINED EXHAUST AND SUPPLY)
3500 TO 5000 CFM

OVERALL SIZE

LENGTH: 9'-0"
WIDTH: 6'-0"
HEIGHT: 4'-9"
DOES NOT INCLUDE EXHAUST OUTLET DUCT COLLAR
WEIGHT: 2400 LBS.

COIL DATA

SIZE: 30" x 48"
FACE AREA: 10 SQ. FT.
RANGE: 390-560 FPM

PLUMBING REQUIREMENTS

H.W. REQ'D – 140° MIN. 180° MAX.
WATER PRESS. – 40 PSI MIN. 80 PSI MAX.
AVERAGE WASH CYCLE BETWEEN 5 – 7 MIN.

SUPPLY TO EXHAUST RATIO	80%						90%						100%					
EXHAUST FAN DATA — NEAREST EXHAUST VOLUME (CFM)	2000		2400		2750		1900		2300		2650		1800		2150		2500	
EXTERNAL STATIC PRESSURE	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.
1.5"	13	1.5	15	2.0	15	3.0	13	1.5	15	2.0	15	3.0	13	1.5	15	1.5	15	2.0
2.0"	13	1.5	15	2.0	15	3.0	13	1.5	15	2.0	15	3.0	13	1.5	15	2.0	15	3.0
2.5"	15	2.0	15	2.0	15	3.0	15	2.0	15	2.0	15	3.0	13	1.5	15	2.0	15	3.0
SUPPLY FAN DATA — NEAREST SUPPLY VOLUME (CFM)	1600		1900		2200		1700		2100		2400		1800		2150		2500	
EXTERNAL STATIC PRESSURE	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.
0.5"	9	1.0	9	1.5	11	1.5	9	1.0	9	1.5	11	1.5	9	1.0	9	1.5	11	1.5
0.75"	9	1.0	9	1.5	11	1.5	9	1.0	9	1.5	11	1.5	9	1.0	9	1.5	11	2.0
1.0"	9	1.0	9	1.5	11	1.5	9	1.0	9	1.5	11	1.5	9	1.0	9	1.5	11	2.0
SUPPLY RECOVERY FACTOR	.66		.63		.62		.62		.59		.57		.59		.57		.54	
PLUMBING DATA — GPM@40 PSI	4						3.5						3					
H.W. SIZE	1/2"						1/2"						1/2"					
DRAIN SIZE	1½"						1½"						1½"					

HRU FRAME SIZE - 3

TOTAL AIR CAPACITY RANGE (COMBINED EXHAUST AND SUPPLY)
5000 TO 6000 CFM

OVERALL SIZE

LENGTH: 9'-0"
WIDTH: 6'-0"
HEIGHT: 5'-6"
DOES NOT INCLUDE EXHAUST OUTLET DUCT COLLAR
WEIGHT: 2500 LBS.

COIL DATA

SIZE: 36" x 48"
FACE AREA: 12 SQ. FT.
RANGE: 440-530 FPM

PLUMBING REQUIREMENTS

H.W. REQ'D – 140° MIN. 180° MAX.
WATER PRESS. – 40 PSI MIN. 80 PSI MAX.
AVERAGE WASH CYCLE BETWEEN 5 – 7 MIN.

SUPPLY TO EXHAUST RATIO	80%						90%						100%					
EXHAUST FAN DATA — NEAREST EXHAUST VOLUME (CFM)	2750		3000		3300		2650		2900		3200		2500		2750		3000	
EXTERNAL STATIC PRESSURE	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.
1.5"	15	2.0	18	2.0	18	3.0	15	2.0	18	2.0	18	3.0	15	2.0	15	2.0	18	3.0
2.0"	15	3.0	18	3.0	18	3.0	15	3.0	18	3.0	18	3.0	15	2.0	15	3.0	18	3.0
2.5"	15	3.0	18	3.0	18	5.0	15	3.0	18	3.0	18	3.0	15	3.0	15	3.0	18	3.0
SUPPLY FAN DATA — NEAREST SUPPLY VOLUME (CFM)	2200		2400		2650		2400		2600		2900		2500		2750		3000	
EXTERNAL STATIC PRESSURE	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.
0.5"	9	1.5	11	1.5	11	2.0	11	1.5	11	1.5	11	2.0	11	2.0	12	2.0	12	3.0
0.75"	9	1.5	11	1.5	11	2.0	11	1.5	11	2.0	11	3.0	11	2.0	12	2.0	12	3.0
1.0"	9	1.5	11	2.0	11	3.0	11	2.0	11	2.0	11	3.0	11	2.0	12	2.0	12	3.0
SUPPLY RECOVERY FACTOR	.65		.63		.62		.60		.59		.57		.58		.57		.55	
PLUMBING DATA — GPM@40 PSI	5						4.5						4					
H.W. SIZE	1/2"						1/2"						1/2"					
DRAIN SIZE	1½"						1½"						1½"					

HRU FRAME SIZE - 4

TOTAL AIR CAPACITY RANGE (COMBINED EXHAUST AND SUPPLY)
6000 TO 7500 CFM

OVERALL SIZE

LENGTH: 10'-0"
WIDTH: 8'-0"
HEIGHT: 4'-9"
DOES NOT INCLUDE EXHAUST OUTLET DUCT COLLAR
WEIGHT: 3000 LBS.

COIL DATA

SIZE: 30" x 72"
FACE AREA: 15 SQ. FT.
RANGE: 450-560 FPM

PLUMBING REQUIREMENTS

H.W. REQ'D – 140° MIN. 180° MAX.
WATER PRESS. – 40 PSI MIN. 80 PSI MAX.
AVERAGE WASH CYCLE BETWEEN 5 – 7 MIN.

	SUPPLY TO EXHAUST RATIO	80%						90%						100%					
EXHAUST FAN DATA	NEAREST EXHAUST VOLUME (CFM)	3300		3700		4000		3200		3600		4000		3000		3400		3700	
	EXTERNAL STATIC PRESSURE	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.
	1.5"	18	3.0	18	3.0	20	3.0	18	2.0	18	3.0	20	3.0	18	2.0	18	3.0	18	3.0
	2.0"	18	3.0	18	3.0	18	5.0	18	3.0	18	3.0	18	5.0	18	3.0	18	3.0	18	5.0
	2.5"	15	5.0	18	5.0	18	5.0	15	5.0	18	5.0	18	5.0	18	5.0	18	5.0	18	5.0
SUPPLY FAN DATA	NEAREST SUPPLY VOLUME (CFM)	2600		2950		3200		2900		3200		3600		3000		3400		3700	
	EXTERNAL STATIC PRESSURE	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.
	0.5"	11	1.5	12	2.0	12	2.0	12	2.0	12	2.0	12	3.0	12	2.0	12	2.0	12	3.0
	0.75"	11	2.0	12	2.0	12	3.0	12	2.0	12	3.0	12	3.0	12	2.0	12	2.0	12	3.0
	1.0"	11	2.0	12	2.0	12	3.0	12	2.0	12	3.0	12	3.0	12	2.0	12	2.0	12	3.0
SUPPLY RECOVERY FACTOR		.65		.63		.62		.60		.59		.57		.58		.56		.54	
PLUMBING DATA	GPM@40 PSI	6						5.5						5					
	H.W. SIZE	3/4"						3/4"						3/4"					
	DRAIN SIZE	1½"						1½"						1½"					

HRU FRAME SIZE - 5

TOTAL AIR CAPACITY RANGE (COMBINED EXHAUST AND SUPPLY)
7500 TO 9000 CFM

OVERALL SIZE

LENGTH: 10'-0"
WIDTH: 8'-0"
HEIGHT: 5'-6"
DOES NOT INCLUDE EXHAUST OUTLET DUCT COLLAR
WEIGHT: 3200 LBS.

COIL DATA

SIZE: 36" x 72"
FACE AREA: 18 SQ. FT.
RANGE: 440-530 FPM

PLUMBING REQUIREMENTS

H.W. REQ'D – 140° MIN. 180° MAX.
WATER PRESS. – 40 PSI MIN. 80 PSI MAX.
AVERAGE WASH CYCLE BETWEEN 5 – 7 MIN.

	SUPPLY TO EXHAUST RATIO	80%						90%						100%					
EXHAUST FAN DATA	NEAREST EXHAUST VOLUME (CFM)	4100		4500		4900		4000		4400		4700		3800		4100		4500	
	EXTERNAL STATIC PRESSURE	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.
	1.5"	20	3.0	20	5.0	20	5.0	20	3.0	20	5.0	20	5	20	3.0	20	3.0	20	5.0
	2.0"	20	3.0	20	5.0	20	5.0	20	3.0	20	5.0	20	5	20	3.0	20	5.0	20	5.0
	2.5"	18	5.0	20	5.0	20	5.0	18	5.0	20	5.0	20	5	18	5.0	18	5.0	20	5.0
SUPPLY FAN DATA	NEAREST SUPPLY VOLUME (CFM)	3300		3600		3900		3600		4000		4200		3800		4100		4500	
	EXTERNAL STATIC PRESSURE	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.
	0.5"	12	2.0	12	3.0	12	3.0	12	2.0	12	3.0	12	3.0	12	3.0	12	3.0	12	5.0
	0.75"	12	2.0	12	3.0	12	3.0	12	3.0	12	3.0	12	3.0	12	3.0	12	3.0	12	5.0
	1.0"	12	3.0	12	3.0	12	3.0	12	3.0	12	3.0	12	5.0	12	3.0	12	5.0	12	5.0
SUPPLY RECOVERY FACTOR		.65		.63		.62		.60		.59		.57		.58		.57		.55	
PLUMBING DATA	GPM@40 PSI	6.5						6.5						6					
	H.W. SIZE	3/4"						3/4"						3/4"					
	DRAIN SIZE	2"						2"						2"					

HRU FRAME SIZE - 6

TOTAL AIR CAPACITY RANGE (COMBINED EXHAUST AND SUPPLY)
9000 TO 11000 CFM

OVERALL SIZE

LENGTH: 11'-0"
WIDTH: 8'-0"
HEIGHT: 6'-3"
DOES NOT INCLUDE EXHAUST OUTLET DUCT COLLAR
WEIGHT: 3500 LBS.

COIL DATA

SIZE: 42" x 72"
FACE AREA: 21 SQ. FT.
RANGE: 440-540 FPM

PLUMBING REQUIREMENTS

H.W. REQ'D – 140° MIN. 180° MAX.
WATER PRESS. – 40 PSI MIN. 80 PSI MAX.
AVERAGE WASH CYCLE BETWEEN 5 – 7 MIN.

	SUPPLY TO EXHAUST RATIO	80%						90%						100%					
EXHAUST FAN DATA	NEAREST EXHAUST VOLUME (CFM)	5000		5500		6000		4800		5300		5800		4500		5000		5500	
	EXTERNAL STATIC PRESSURE	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.
	1.5"	20	5.0	20	5.0	22	5.0	20	3.0	20	5.0	20	5.0	20	3.0	20	5.0	20	5.0
	2.0"	20	5.0	20	5.0	20	7.5	20	5.0	20	5.0	20	7.5	20	5.0	20	5.0	20	5.0
	2.5"	20	5.0	20	5.0	20	7.5	20	5.0	20	5.0	20	7.5	20	5.0	20	5.0	20	7.5
SUPPLY FAN DATA	NEAREST SUPPLY VOLUME (CFM)	4000		4400		4800		4300		4800		5200		4500		5000		5500	
	EXTERNAL STATIC PRESSURE	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.
	0.5"	12	3.0	12	3.0	13	3.0	12	3.0	13	3.0	13	5.0	12	3.0	13	5.0	15	5.0
	0.75"	12	3.0	12	5.0	12	5.0	12	3.0	13	5.0	13	5.0	12	3.0	13	5.0	15	5.0
	1.0"	12	3.0	12	5.0	12	5.0	12	3.0	13	5.0	13	5.0	12	5.0	13	5.0	15	5.0
SUPPLY RECOVERY FACTOR		.65		.63		.62		.60		.59		.57		.58		.57		.55	
PLUMBING DATA	GPM@40 PSI	8						7.5						7					
	H.W. SIZE	1"						1"						1"					
	DRAIN SIZE	2"						2"						2"					

HRU FRAME SIZE - 7

TOTAL AIR CAPACITY RANGE (COMBINED EXHAUST AND SUPPLY)
10000 TO 13000 CFM

OVERALL SIZE

LENGTH: 11'-6"
WIDTH: 8'-0"
HEIGHT: 7'-0"
DOES NOT INCLUDE EXHAUST OUTLET DUCT COLLAR
WEIGHT: 3900 LBS.

COIL DATA

SIZE: 48" x 72"
FACE AREA: 24 SQ. FT.
RANGE: 460-550 FPM

PLUMBING REQUIREMENTS

H.W. REQ'D – 140° MIN. 180° MAX.
WATER PRESS. – 40 PSI MIN. 80 PSI MAX.
AVERAGE WASH CYCLE BETWEEN 5 – 7 MIN.

	SUPPLY TO EXHAUST RATIO	80%						90%						100%					
EXHAUST FAN DATA	NEAREST EXHAUST VOLUME (CFM)	6100		6600		7100		5800		6400		6900		5500		6000		6500	
	EXTERNAL STATIC PRESSURE	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.
	1.5"	22	5.0	22	7.5	24	7.5	22	5.0	22	5.0	24	7.5	20	5.0	22	5.0	22	7.5
	2.0"	22	5.0	22	7.5	24	7.5	22	5.0	22	7.5	24	7.5	20	5.0	22	5.0	22	7.5
	2.5"	20	7.5	22	7.5	22	7.5	20	7.5	22	7.5	22	7.5	20	5.0	20	7.5	22	7.5
SUPPLY FAN DATA	NEAREST SUPPLY VOLUME (CFM)	4900		5300		5700		5200		5800		6200		5500		6000		6500	
	EXTERNAL STATIC PRESSURE	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.
	0.5"	13	3.0	15	5.0	15	5.0	13	3.0	15	5.0	15	5.0	15	3.0	15	5.0	16	5.0
	0.75"	13	3.0	15	5.0	15	5.0	13	5.0	15	5.0	15	5.0	15	5.0	15	5.0	16	5.0
	1.0"	12	5.0	13	5.0	15	5.0	13	5.0	13	5.0	15	5.0	15	5.0	13	5.0	15	5.0
SUPPLY RECOVERY FACTOR		.65		.64		.62		.59		.58		.56		.58		.56		.54	
PLUMBING DATA	GPM@40 PSI	9.5						9						8.5					
	H.W. SIZE	1"						1"						1"					
	DRAIN SIZE	2"						2"						2"					

HRU FRAME SIZE - 8

TOTAL AIR CAPACITY RANGE (COMBINED EXHAUST AND SUPPLY)
13000 TO 16000 CFM

OVERALL SIZE
LENGTH: 13′-0″
WIDTH: 8′-0″
HEIGHT: 8′-0″
DOES NOT INCLUDE EXHAUST OUTLET DUCT COLLAR
WEIGHT: 4200 LBS.

COIL DATA
SIZE: 54″ x 72″
FACE AREA: 27 SQ. FT.
RANGE: 480-590 FPM

PLUMBING REQUIREMENTS
H.W. REQ'D - 140° MIN.
180° MAX.
WATER PRESS. - 40 PSI MIN.
80 PSI MAX.
AVERAGE WASH CYCLE BETWEEN 5-7 MIN.

SUPPLY TO EXHAUST RATIO	80%						90%						100%					
EXHAUST FAN DATA — NEAREST EXHAUST VOLUME (CFM)	7200		8000		8800		7000		7700		8500		6500		7300		8000	
EXTERNAL STATIC PRESSURE	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.
1.5″	27	5.0	27	7.5	30	7.5	24	5.0	27	7.5	27	7.5	24	5.0	27	5.0	27	7.5
2.0″	27	7.5	27	7.5	30	7.5	24	7.5	27	7.5	27	7.5	24	5.0	27	7.5	27	7.5
2.5″	24	7.5	27	7.5	27	10.0	24	7.5	27	7.5	27	10.0	24	7.5	27	7.5	27	10.0
SUPPLY FAN DATA — NEAREST SUPPLY VOLUME (CFM)	5800		6400		7000		6300		7000		7500		6500		7300		8000	
EXTERNAL STATIC PRESSURE	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.
0.5″	15	5.0	16	5.0	16	5.0	16	5.0	16	5.0	16	5.0	16	5.0	16	5.0	18	5.0
0.75″	15	5.0	16	5.0	16	5.0	16	5.0	16	5.0	16	5.0	16	5.0	16	5.0	18	7.5
1.0″	15	5.0	16	5.0	16	7.5	16	5.0	16	5.0	16	7.5	16	5.0	16	7.5	18	7.5
SUPPLY RECOVERY FACTOR	.63		.62		.60		.59		.57		.56		.57		.55		.53	
PLUMBING DATA — GPM @ 40 PSI	12						11						10.5					
H.W. SIZE	1¼″						1¼″						1¼″					
DRAIN SIZE	3″						3″						3″					

HRU FRAME SIZE-9A,B, or C

TOTAL AIR CAPACITY RANGE (COMBINED EXHAUST AND SUPPLY)
16000 TO 22000 CFM **

OVERALL SIZE

LENGTH:	WIDTH:	*HEIGHT:
(A) 13′-0″	(A) 10′-0″	(A) 7′-9″
(B) 13′-0″	(B) 10′-0″	(B) 8′-0″
(C) 13′-6″	(C) 10′-0″	(C) 8′-3″

WEIGHT:
(A) 4500 LBS.
(B) 4800 LBS.
(C) 5000 LBS.

* DOES NOT INCLUDE EXHAUST OUTLET DUCT COLLAR

COIL DATA
SIZE: 54″ x 96″
FACE AREA: 36 SQ. FT.
RANGE: 440-610 FPM

PLUMBING REQUIREMENTS
H.W. REQ'D - 140° MIN.
180° MAX.
WATER PRESS. - 40 PSI MIN.
80 PSI MAX.
AVERAGE WASH CYCLE BETWEEN 5-7 MIN.

SUPPLY TO EXHAUST RATIO	80%						90%						100%					
EXHAUST FAN DATA — NEAREST EXHAUST VOLUME (CFM)	A 9000		B 10500		C 12000		A 8500		B 10000		C 11500		A 8000		B 9500		C 11000	
EXTERNAL STATIC PRESSURE	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.
1.5″	27	7.5	30	10.0	30	10.0	27	7.5	30	10.0	30	10.0	27	7.5	30	10.0	30	10.0
2.0″	27	7.5	30	10.0	30	10.0	27	7.5	30	10.0	30	10.0	27	7.5	30	10.0	30	10.0
2.5″	27	10.0	30	10.0	30	15.0	27	7.5	30	10.0	30	15.0	27	7.5	30	10.0	30	15.0
SUPPLY FAN DATA — NEAREST SUPPLY VOLUME (CFM)	A 7200		B 8500		C 9600		A 7500		B 9000		C 10500		A 8000		B 9500		C 11000	
EXTERNAL STATIC PRESSURE	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.	FAN WHEEL SIZE	MOTOR H.P.
0.5″	16	5.0	18	5.0	20	7.5	16	5.0	20	5.0	20	7.5	18	5.0	20	7.5	20	7.5
0.75″	16	5.0	18	7.5	20	7.5	16	5.0	20	7.5	20	7.5	18	5.0	20	7.5	20	10.0
1.0″	16	5.0	18	7.5	20	7.5	16	5.0	20	7.5	20	10.0	18	5.0	20	7.5	20	10.0
SUPPLY RECOVERY FACTOR	.65		.62		.60		.61		.58		.54		.58		.56		.53	
PLUMBING DATA — GPM @ 40 PSI	15						14.5						13.5					
H.W. SIZE	1¼″						1¼″						1¼″					
DRAIN SIZE	3″						3″						3″					

** NOTE: UNITS OVER 22,000 CFM AVAILABLE: CONSULT FACTORY

E M C ENGINEERS, INC.
2750 S. Wadsworth Blvd. Suite C-200 Denver, CO 80227 (303) 988-2951
9755 Dogwood Rd. Suite 220 Roswell, GA 30075 (404) 642-1864

JOB 1406-005 ~~HV~~AC Upgrade Ft Riley, Ks
SHEET NO. ______ OF ______
CALCULATED BY C. Wohlert DATE 2/24/95
CHECKED BY ______ DATE ______
SCALE Building 7245

Kitchen Heat Recovery Units.

Rex Cooper Gaylord Industries, inc 1-800-547-9696

Size ~~2~~ = 3,500 -> 5000 cfm (supp + exhaust)

$ 11,800 coil = $4000 w/ all controls
2,500 wash system } total ~~$[illegible]~~ $ 18,300

Size 1 = 11,000 unit
3,000 coil
2,500 cabinet
16,500 total

2,500 - 3,500 total cfm

Size ~~5~~ = 15,500 unit
4,000 coil
3,000 cabinet
$ 22,500 total

7,500 - 9,500 total cfm

Size 8 I
21,000 unit
4,500 coil
3,000 cabinet
$ 28,500

13,000 - 16,000 total cfm

Size 9 C
27,000 unit
5,000 coil
4,500 cabinet
$ 36,500

16,000 - 22,000 total cfm

LIFE CYCLE COST ANALYSIS SUMMARY
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

LOCATION:	Fort Riley	REGION: 2 (Kansas)		PROJECT NO:	1406-005
PROJECT TITLE:	Feasibility Study for HVAC Upgrade			FISCAL YEAR:	1995
ANALYSIS DATE:	05/04/95	ECONOMIC LIFE:	20	PREPARED BY:	C. Wohlert

1. INVESTMENT: **BLDG 7245 - Replace Large STM Boiler w/ Smaller STM & HW Boilers**

A.	CONSTRUCTION COST	=	$65,099	
B.	SIOH COST	(5.5% of 1A) =	$3,580	
C.	DESIGN COST	(6.0% of 1A) =	$3,906	
D.	TOTAL COST	(1A +1B +1C) =	$72,585	
E.	SALVAGE VALUE OF EXISTING EQUIPMENT =		$0	
F.	PUBLIC UTILITY COMPANY REBATE =		$0	
G.	TOTAL INVESTMENT	(1D -1E -1F) =	------->	$72,585

2. ENERGY SAVINGS (+) OR COST (-):

DATE OF NISTR 85-3273-9 USED FOR DISCOUNT FACTORS: JAN '95

	ENERGY SOURCE	FUEL COST $/MBTU (1)	SAVINGS MBTU/YR (2)	ANNUAL $ SAVINGS (3)	DISCOUNT FACTOR (4)	DISCOUNTED SAVINGS (5)	
A.	ELECT.	$12.10	(111)	($1,338)	15.88	($21,247)	
B.	DIST	$0.00	0	$0	19.16	$0	
C.	NAT GAS	$4.12	1,528	$6,295	18.30	$115,205	
D.	COAL	$0.00	0	$0	16.62	$0	
E.	ELEC. DEMAND			$0	14.88	$0	
F.	TOTAL		1,417	$4,957		-------->	$93,958

3. NON-ENERGY SAVINGS (+) OR COST (-)

A. ANNUAL RECURRING (+/-)

1 ANNUAL MAINTENANCE	($181)	14.88	($2,693)
2	$0	14.88	$0
3	$0	14.88	$0
4 TOTAL ANNUAL DISC. SAVINGS (+) / COST	($181)		($2,693)

B. NON-RECURRING (+/-)

ITEM	SAVINGS (+) COST(-) (1)	YEAR OF OCCURRENCE (2)	DISCOUNT FACTOR (3) (TABLE A-2)	DISCOUNTED SAVINGS/COST (4)
a. BASELINE EQUIP. REPLACEMEN	$101,942	5	0.863	$87,976
b.				$0
c.				$0
d.				$0
e.				$0
f. TOTAL	$101,942			$87,976

C. TOTAL NON-ENERGY DISCOUNTED SAVINGS (+) OR COST (-) (3A4 + 3Bf4) = $85,284

4. FIRST YEAR DOLLAR SAVINGS (+) / COSTS (-)	(2F3+3A4+(3Bf1/Economic Life))	$9,874
5. SIMPLE PAYBACK (SPB) IN YEARS (MUST BE < 10 YEARS TO QUALIFY)	(1G/4) =	7.35
6. TOTAL NET DISCOUNTED SAVINGS	(2F5 + 3C) =	$179,241
7. DISCOUNTED SAVINGS-TO-INVESTMENT RATIO (SIR) (MUST HAVE SIR > 1.25 TO QUALIFY)	(6/1G) =	2.47

ENGINEER'S OPINION OF PROBABLE COST

PROJECT	Fort Riley Feasibility Study for HVAC Upgrade	SHEET 1 OF 1	
ENGINEER	E M C Engineers, Inc. Denver, CO	DATE PREPARED	4-May-95
		ESTIMATOR	C. Wohlert
		CHECKED BY	A. Niemeyer

Line No.	Item Refer Code	Item Description	Unit of Measure	MATERIAL COST Quantity	MATERIAL COST Unit Cost	MATERIAL COST Total	LABOR COST Crew/ Worker	LABOR COST Hours/ Unit	LABOR COST Total	TOTAL
1		**BUILDING 7245**								
2		**PROPOSED SYSTEM MODIFICATIONS**								
3										
4		*NEW SYSTEMS INSTALLATION*								
5		BOILER, STEAM, 2 MBH, 85%	EA.	1.0	$15,640	$15,640	Q-7	35.556	$731	$16,371
6		BOILER, HOT WATER, 2 MBH, 85%	EA.	1.0	$16,110	$16,110	Q-7	32	$658	$16,768
7	STLPIP2	STEEL PIPE SCH. 40, 2" W/HANGERS	L.F.	90.0	$3.91	$352	Q-1	0.25	$436	$789
8		VALVES & FITTINGS, 25%				$88			$109	$197
9	INSLPIP2	2" FIBERGLASS PIPE INSULATION, 1.5" THCK	L.F.	90.0	$1.46	$132	Q-14	0.084	$139	$271
10	STLPIP6	STEEL PIPE SCH. 40, 6" W/HANGERS	L.F.	25.0	$17.93	$448	Q-16	0.667	$362	$810
11		FITTINGS, 10%				$45			$36	$81
12	INSLPIP6	6" FIBERGLASS PIPE INSULATION, 1.5" THCK	L.F.	25.0	$2.18	$55	Q-14	0.145	$67	$121
13	PMP5HP	PUMP, 5 HP	EA	1.0	$1,114.35	$1,114	Q-1	8.889	$172	$1,287
14										
15										
16										
17										
18										
19										
20										
21		*EXISTING SYSTEMS DEMOLITION*								
22		BOILER DEMOLITION	EA.	1.0			Q-6	275	$5,529	$5,529
23										
24										
25										
26										
27										
28										
29										
30										
31		**SUBTOTAL**				$33,984			$8,240	$42,224
32	OH	OVERHEAD			17%	$5,709			$1,384	$7,094
33	PRO	PROFIT			10%	$3,969			$962	$4,932
34	CONT	CONTINGENCY			20%	$8,733			$2,117	$10,850
35	**TOTAL COST**		-	-	-	$52,395	-	-	$12,704	$65,099

ENGINEER'S OPINION OF PROBABLE COST

PROJECT	Fort Riley Feasibility Study for HVAC Upgrade	**SHEET** 1 **OF** 1	
		DATE PREPARED	4-May-95
ENGINEER	E M C Engineers, Inc.	**ESTIMATOR**	C. Wohlert
	Denver, CO	**CHECKED BY**	A. Niemeyer

Line No.	Item Refer Code	Item Description	Unit of Measure	MATERIAL COST Quantity	MATERIAL COST Unit Cost	MATERIAL COST Total	LABOR COST Crew/ Worker	LABOR COST Hours/ Unit	LABOR COST Total	TOTAL
1		**BUILDING 7245**								
2		**NON-RECURRING**								
3										
4		*BASELINE - EXISTING EQUIP. REPLACEMENT*								
5	BOIL6.97	CAST IRON STEAM BOILER, 6.97 MBH	EA.	1.0	$51,357	$51,357	Q-7	400	$8,222	$59,579
6	STLPIP6	STEEL PIPE SCH. 40, 6" W/HANGERS	L.F.	25.0	$17.93	$448	Q-16	0.667	$362	$810
7		FITTINGS, 10%				$45			$36	$81
8	INSLPIP6	6" FIBERGLASS PIPE INSULATION, 1.5" THCK	L.F.	25.0	$2.18	$55	Q-14	0.145	$67	$121
9										
10										
11										
12										
13										
14										
15										
16										
17										
18										
19										
20										
21		*EXISTING SYSTEMS DEMOLITION*								
22		BOILER DEMOLITION	EA.	1.0			Q-6	275	$5,529	$5,529
23										
24										
25										
26										
27										
28										
29										
30										
31		**SUBTOTAL**				$51,904			$14,216	$66,121
32	OH	OVERHEAD			17%	$8,720			$2,388	$11,108
33	PRO	PROFIT			10%	$6,062			$1,660	$7,723
34	CONT	CONTINGENCY			20%	$13,337			$3,653	$16,990
35	**TOTAL COST**		-	-	-	$80,024	-	-	$21,918	$101,942

ENGINEER'S OPINION OF PROBABLE COST

PROJECT	Fort Riley Feasibility Study for HVAC Upgrade	**SHEET** 1 **OF** 1	
		DATE PREPARED	4-May-95
ENGINEER	E M C Engineers, Inc.	**ESTIMATOR**	C. Wohlert
	Denver, CO	**CHECKED BY**	A. Niemeyer

Line No.	Item Refer Code	Item Description	Unit of Measure	MATERIAL COST Quantity	MATERIAL COST Unit Cost	MATERIAL COST Total	LABOR COST Crew/ Worker	LABOR COST Hours/ Unit	LABOR COST Total	TOTAL
1		**BUILDING 7245**								
2		***ANNUAL RECURRING***								
3		***ANNUAL MAINTENANCE COST - BASELINE***								
4	MNT-BLR	MAINT. ON BOILERS - >2.5 MBH	EA.	1.0	$96.90	$97	Q-6	25	$503	$600
5										
6										
7										
8										
9										
10										
11										
12										
13										
14										
15	**TOTAL ANNUAL MAINTENANCE COST - BASELINE**		-	-	-	$97	-	-	$503	$600
16										
17		***ANNUAL MAINTENANCE COST - NEW HVAC REPLACEMENT***								
18	MNT-BLR	MAINT. ON BOILERS - <2.5 MBH	EA.	2.0	$48.45	$97	Q-6	17	$684	$780
19										
20										
21										
22										
23										
24										
25										
26										
27										
28										
29	**TOTAL ANNUAL MAINTENANCE COST - BASELINE**		-	-	-	$97	-	-	$684	$780
30										
31										
32										
33										
34										
35	**TOTAL ANNUAL MAINTENANCE COST SAVINGS**		-	-	-	$0	-	-	($181)	($181)

LIFE CYCLE COST ANALYSIS SUMMARY

ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

LOCATION:	Fort Riley	REGION: 2 (Kansas)		PROJECT NO:	1406-005
PROJECT TITLE:	Feasibility Study for HVAC Upgrade			FISCAL YEAR:	1995
ANALYSIS DATE:	05/24/95	ECONOMIC LIFE:	20	PREPARED BY:	C. Wohlert

1. INVESTMENT: **BLDGS 7606 and 7654 (each) - Replace Large STM Boiler w/ Smaller STM & HW Boilers**

A.	CONSTRUCTION COST	=	$80,100	
B.	SIOH COST	(5.5% of 1A) =	$4,406	
C.	DESIGN COST	(6.0% of 1A) =	$4,806	
D.	TOTAL COST	(1A +1B +1C) =	$89,312	
E.	SALVAGE VALUE OF EXISTING EQUIPMENT	=	$0	
F.	PUBLIC UTILITY COMPANY REBATE	=	$0	
G.	TOTAL INVESTMENT	(1D -1E -1F) =	------->	$89,312

2. ENERGY SAVINGS (+) OR COST (-):

DATE OF NISTR 85-3273-9 USED FOR DISCOUNT FACTORS: JAN '95

	ENERGY SOURCE	FUEL COS $/MBTU (1)	SAVINGS MBTU/YR (2)	ANNUAL $ SAVINGS (3)	DISCOUNT FACTOR (4)	DISCOUNTED SAVINGS (5)	
A.	ELECT.	$12.10	(111)	($1,338)	15.88	($21,247)	
B.	DIST	$0.00	0	$0	19.16	$0	
C.	NAT GAS	$4.12	1,528	$6,295	18.30	$115,205	
D.	COAL	$0.00	0	$0	16.62	$0	
E.	ELEC. DEMAND			$0	14.88	$0	
F.	TOTAL		1,417	$4,957		-------->	$93,958

3. NON-ENERGY SAVINGS (+) OR COST (-)

A. ANNUAL RECURRING (+/-)

1 ANNUAL MAINTENANCE	($181)	14.88	($2,693)
2	$0	14.88	$0
3	$0	14.88	$0
4 TOTAL ANNUAL DISC. SAVINGS (+) / COST	($181)		($2,693)

B. NON-RECURRING (+/-)

ITEM	SAVINGS (+) COST(-) (1)	YEAR OF OCCURRENCE (2)	DISCOUNT FACTOR (3) (TABLE A-2)	DISCOUNTED SAVINGS/COST (4)
a. BASELINE EQUIP. REPLACEMEN	$101,942	5	0.863	$87,976
b.				$0
c.				$0
d.				$0
e.				$0
f. TOTAL	$101,942			$87,976

C. TOTAL NON-ENERGY DISCOUNTED SAVINGS (+) OR COST (-) (3A4 + 3Bf4) = $85,284

4.	FIRST YEAR DOLLAR SAVINGS (+) / COSTS (-)	(2F3+3A4+(3Bf1/Economic Life))	$9,874
5.	SIMPLE PAYBACK (SPB) IN YEARS (MUST BE < 10 YEARS TO QUALIFY)	(1G/4) =	9.05
6.	TOTAL NET DISCOUNTED SAVINGS	(2F5 + 3C) =	$179,241
7.	DISCOUNTED SAVINGS-TO-INVESTMENT RATIO (SIR) (MUST HAVE SIR > 1.25 TO QUALIFY)	(6/1G) =	2.01

ENGINEER'S OPINION OF PROBABLE COST

PROJECT	Fort Riley Feasibility Study for HVAC Upgrade	**SHEET** 1 **OF** 1	
		DATE PREPARED	24-May-95
ENGINEER	E M C Engineers, Inc.	**ESTIMATOR**	C. Wohlert
	Denver, CO	**CHECKED BY**	A. Niemeyer

Line No.	Item Refer Code	Item Description	Unit of Measure	MATERIAL COST Quantity	MATERIAL COST Unit Cost	MATERIAL COST Total	LABOR COST Crew/ Worker	LABOR COST Hours/ Unit	LABOR COST Total	TOTAL
1		**BUILDINGS 7606 and 7654 (each)**								
2		**PROPOSED SYSTEM MODIFICATIONS**								
3										
4		*NEW SYSTEMS INSTALLATION*								
5		BOILER, STEAM, 2 MBH, 85%	EA.	1.0	$15,640	$15,640	Q-7	35.556	$731	$16,371
6		BOILER, HOT WATER, 2 MBH, 85%	EA.	1.0	$16,110	$16,110	Q-7	32	$658	$16,768
7	STLPIP2	STEEL PIPE SCH. 40, 2" W/HANGERS	L.F.	90.0	$3.91	$352	Q-1	0.25	$436	$789
8		VALVES & FITTINGS, 25%				$88			$109	$197
9	INSLPIP2	2" FIBERGLASS PIPE INSULATION, 1.5" THCK	L.F.	90.0	$1.46	$132	Q-14	0.084	$139	$271
10	STLPIP6	STEEL PIPE SCH. 40, 6" W/HANGERS	L.F.	25.0	$17.93	$448	Q-16	0.667	$362	$810
11		FITTINGS, 10%				$45			$36	$81
12	INSLPIP6	6" FIBERGLASS PIPE INSULATION, 1.5" THCK	L.F.	25.0	$2.18	$55	Q-14	0.145	$67	$121
13	PMP5HP	PUMP, 5 HP	EA	1.0	$1,114.35	$1,114	Q-1	8.889	$172	$1,287
14										
15										
16										
17										
18										
19										
20										
21		*EXISTING SYSTEMS DEMOLITION*								
22		BOILER DEMOLITION	EA.	1.0			Q-6	275	$5,529	$5,529
23		ASBESTOS REMOVAL (HRU)	GLV. BAG	38.0	$170.00	$6,460				$6,460
24		ASBESTOS REMOVAL (BOILER)	FLUE	1.0	$3,270.00	$3,270				$3,270
25										
26										
27										
28										
29										
30										
31		**SUBTOTAL**				$43,714			$8,240	$51,954
32	OH	OVERHEAD			17%	$7,344			$1,384	$8,728
33	PRO	PROFIT			10%	$5,106			$962	$6,068
34	CONT	CONTINGENCY			20%	$11,233			$2,117	$13,350
35	**TOTAL COST**		-	-	-	$67,396	-	-	$12,704	$80,100

ENGINEER'S OPINION OF PROBABLE COST		SHEET 1 OF 1
PROJECT	Fort Riley Feasibility Study for HVAC Upgrade	**DATE PREPARED** 24-May-95
ENGINEER	E M C Engineers, Inc.	**ESTIMATOR** C. Wohlert
	Denver, CO	**CHECKED BY** A. Niemeyer

Line No.	Item Refer Code	Item Description	Unit of Measure	MATERIAL COST Quantity	MATERIAL COST Unit Cost	MATERIAL COST Total	LABOR COST Crew/ Worker	LABOR COST Hours/ Unit	LABOR COST Total	TOTAL
1		**BUILDINGS 7606 and 7654 (each)**								
2		***ANNUAL RECURRING***								
3		***ANNUAL MAINTENANCE COST - BASELINE***								
4	MNT-BLR	MAINT. ON BOILERS - >2.5 MBH	EA.	1.0	$96.90	$97	Q-6	25	$503	$600
5										
6										
7										
8										
9										
10										
11										
12										
13										
14										
15	**TOTAL ANNUAL MAINTENANCE COST - BASELINE**		-	-	-	$97	-	-	$503	$600
16										
17		***ANNUAL MAINTENANCE COST - NEW HVAC REPLACEMENT***								
18	MNT-BLR	MAINT. ON BOILERS - <2.5 MBH	EA.	2.0	$48.45	$97	Q-6	17	$684	$780
19										
20										
21										
22										
23										
24										
25										
26										
27										
28										
29	**TOTAL ANNUAL MAINTENANCE COST - BASELINE**		-	-	-	$97	-	-	$684	$780
30										
31										
32										
33										
34										
35	**TOTAL ANNUAL MAINTENANCE COST SAVINGS**		-	-	-	$0	-	-	($181)	($181)

ENGINEER'S OPINION OF PROBABLE COST

PROJECT	Fort Riley Feasibility Study for HVAC Upgrade	**SHEET** 1	**OF** 1
ENGINEER	E M C Engineers, Inc.	**DATE PREPARED**	24-May-95
	Denver, CO	**ESTIMATOR**	C. Wohlert
		CHECKED BY	A. Niemeyer

Line No.	Item Refer Code	Item Description	Unit of Measure	MATERIAL COST			LABOR COST			TOTAL
				Quantity	Unit Cost	Total	Crew/ Worker	Hours/ Unit	Total	
1		**BUILDINGS 7606 and 7654 (each)**								
2		**NON-RECURRING**								
3										
4		*BASELINE - EXISTING EQUIP. REPLACEMENT*								
5	BOIL6.97	CAST IRON STEAM BOILER, 6.97 MBH	EA.	1.0	$51,357	$51,357	Q-7	400	$8,222	$59,579
6	STLPIP6	STEEL PIPE SCH. 40, 6" W/HANGERS	L.F.	25.0	$17.93	$448	Q-16	0.667	$362	$810
7		FITTINGS, 10%				$45			$36	$81
8	INSLPIP6	6" FIBERGLASS PIPE INSULATION, 1.5" THCK	L.F.	25.0	$2.18	$55	Q-14	0.145	$67	$121
9										
10										
11										
12										
13										
14										
15										
16										
17										
18										
19										
20										
21		*EXISTING SYSTEMS DEMOLITION*								
22		BOILER DEMOLITION	EA.	1.0			Q-6	275	$5,529	$5,529
23										
24										
25										
26										
27										
28										
29										
30										
31		**SUBTOTAL**				$51,904			$14,216	$66,121
32	OH	OVERHEAD			17%	$8,720			$2,388	$11,108
33	PRO	PROFIT			10%	$6,062			$1,660	$7,723
34	CONT	CONTINGENCY			20%	$13,337			$3,653	$16,990
35	**TOTAL COST**		-	-	-	$80,024	-	-	$21,918	$101,942

LIFE CYCLE COST ANALYSIS SUMMARY
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

LOCATION:	Fort Riley	REGION: 2 (Kansas)		PROJECT NO:	1406-005
PROJECT TITLE:	Feasibility Study for HVAC Upgrade			FISCAL YEAR:	1995
ANALYSIS DATE:	05/24/95	ECONOMIC LIFE:	20	PREPARED BY:	C. Wohlert

1. INVESTMENT: **BLDGS 7804 and 7856 (each) - Replace Large STM Boiler w/ Smaller STM & HW Boilers**

A.	CONSTRUCTION COST	=	$70,140	
B.	SIOH COST	(5.5% of 1A) =	$3,858	
C.	DESIGN COST	(6.0% of 1A) =	$4,208	
D.	TOTAL COST	(1A +1B +1C) =	$78,207	
E.	SALVAGE VALUE OF EXISTING EQUIPMENT =		$0	
F.	PUBLIC UTILITY COMPANY REBATE =		$0	
G.	TOTAL INVESTMENT	(1D -1E -1F) =	------->	$78,207

2. ENERGY SAVINGS (+) OR COST (-):

DATE OF NISTR 85-3273-9 USED FOR DISCOUNT FACTORS: JAN '95

	ENERGY SOURCE	FUEL COS $/MBTU (1)	SAVINGS MBTU/YR (2)	ANNUAL $ SAVINGS (3)	DISCOUNT FACTOR (4)	DISCOUNTED SAVINGS (5)	
A.	ELECT.	$12.10	(111)	($1,338)	15.88	($21,247)	
B.	DIST	$0.00	0	$0	19.16	$0	
C.	NAT GAS	$4.12	1,528	$6,295	18.30	$115,205	
D.	COAL	$0.00	0	$0	16.62	$0	
E.	ELEC. DEMAND			$0	14.88	$0	
F.	TOTAL		1,417	$4,957		-------->	$93,958

3. NON-ENERGY SAVINGS (+) OR COST (-)

A. ANNUAL RECURRING (+/-)

1 ANNUAL MAINTENANCE	($181)	14.88	($2,693)
2	$0	14.88	$0
3	$0	14.88	$0
4 TOTAL ANNUAL DISC. SAVINGS (+) / COST	($181)		($2,693)

B. NON-RECURRING (+/-)

ITEM	SAVINGS (+) COST(-) (1)	YEAR OF OCCURRENCE (2)	DISCOUNT FACTOR (3) (TABLE A-2)	DISCOUNTED SAVINGS/COST (4)
a. BASELINE EQUIP. REPLACEMEN	$101,942	5	0.863	$87,976
b.				$0
c.				$0
d.				$0
e.				$0
f. TOTAL	$101,942			$87,976

C. TOTAL NON-ENERGY DISCOUNTED SAVINGS (+) OR COST (-) (3A4 + 3Bf4) = $85,284

4.	FIRST YEAR DOLLAR SAVINGS (+) / COSTS (-)	(2F3+3A4+(3Bf1/Economic Life))	$9,874
5.	SIMPLE PAYBACK (SPB) IN YEARS (MUST BE < 10 YEARS TO QUALIFY)	(1G/4) =	7.92
6.	TOTAL NET DISCOUNTED SAVINGS	(2F5 + 3C) =	$179,241
7.	DISCOUNTED SAVINGS-TO-INVESTMENT RATIO (SIR) (MUST HAVE SIR > 1.25 TO QUALIFY)	(6/1G) =	2.29

ENGINEER'S OPINION OF PROBABLE COST

PROJECT	Fort Riley Feasibility Study for HVAC Upgrade	SHEET 1 OF 1	
ENGINEER	E M C Engineers, Inc.	DATE PREPARED	24-May-95
	Denver, CO	ESTIMATOR	C. Wohlert
		CHECKED BY	A. Niemeyer

Line No.	Item Refer Code	Item Description	Unit of Measure	MATERIAL COST			LABOR COST			TOTAL
				Quantity	Unit Cost	Total	Crew/ Worker	Hours/ Unit	Total	
1		**BUILDINGS 7804 and 7856 (each)**								
2		**PROPOSED SYSTEM MODIFICATIONS**								
3										
4		*NEW SYSTEMS INSTALLATION*								
5		BOILER, STEAM, 2 MBH, 85%	EA.	1.0	$15,640	$15,640	Q-7	35.556	$731	$16,371
6		BOILER, HOT WATER, 2 MBH, 85%	EA.	1.0	$16,110	$16,110	Q-7	32	$658	$16,768
7	STLPIP2	STEEL PIPE SCH. 40, 2" W/HANGERS	L.F.	90.0	$3.91	$352	Q-1	0.25	$436	$789
8		VALVES & FITTINGS, 25%				$88			$109	$197
9	INSLPIP2	2" FIBERGLASS PIPE INSULATION, 1.5" THCK	L.F.	90.0	$1.46	$132	Q-14	0.084	$139	$271
10	STLPIP6	STEEL PIPE SCH. 40, 6" W/HANGERS	L.F.	25.0	$17.93	$448	Q-16	0.667	$362	$810
11		FITTINGS, 10%				$45			$36	$81
12	INSLPIP6	6" FIBERGLASS PIPE INSULATION, 1.5" THCK	L.F.	25.0	$2.18	$55	Q-14	0.145	$67	$121
13	PMP5HP	PUMP, 5 HP	EA	1.0	$1,114.35	$1,114	Q-1	8.889	$172	$1,287
14										
15										
16										
17										
18										
19										
20										
21		*EXISTING SYSTEMS DEMOLITION*								
22		BOILER DEMOLITION	EA.	1.0			Q-6	275	$5,529	$5,529
23		ASBESTOS REMOVAL (BOILER)	FLUE	1.0					$3,270	$3,270
24										
25										
26										
27										
28										
29										
30										
31		**SUBTOTAL**				$33,984			$11,510	$45,494
32	OH	OVERHEAD			17%	$5,709			$1,934	$7,643
33	PRO	PROFIT			10%	$3,969			$1,344	$5,314
34	CONT	CONTINGENCY			20%	$8,733			$2,958	$11,690
35	**TOTAL COST**		-	-	-	$52,395	-	-	$17,745	$70,140

ENGINEER'S OPINION OF PROBABLE COST

PROJECT	Fort Riley Feasibility Study for HVAC Upgrade	SHEET 1 OF 1	
ENGINEER	E M C Engineers, Inc.	DATE PREPARED	24-May-95
	Denver, CO	ESTIMATOR	C. Wohlert
		CHECKED BY	A. Niemeyer

Line No.	Item Refer Code	Item Description	Unit of Measure	MATERIAL COST Quantity	MATERIAL COST Unit Cost	MATERIAL COST Total	LABOR COST Crew/ Worker	LABOR COST Hours/ Unit	LABOR COST Total	TOTAL
1		**BUILDINGS 7804 and 7856 (each)**								
2		***ANNUAL RECURRING***								
3		***ANNUAL MAINTENANCE COST - BASELINE***								
4	MNT-BLR	MAINT. ON BOILERS - >2.5 MBH	EA.	1.0	$96.90	$97	Q-6	25	$503	$600
5										
6										
7										
8										
9										
10										
11										
12										
13										
14										
15	**TOTAL ANNUAL MAINTENANCE COST - BASELINE**		-	-	-	$97	-	-	$503	$600
16										
17		***ANNUAL MAINTENANCE COST - NEW HVAC REPLACEMENT***								
18	MNT-BLR	MAINT. ON BOILERS - <2.5 MBH	EA.	2.0	$48.45	$97	Q-6	17	$684	$780
19										
20										
21										
22										
23										
24										
25										
26										
27										
28										
29	**TOTAL ANNUAL MAINTENANCE COST - BASELINE**		-	-	-	$97	-	-	$684	$780
30										
31										
32										
33										
34										
35	**TOTAL ANNUAL MAINTENANCE COST SAVINGS**		-	-	-	$0	-	-	($181)	($181)

ENGINEER'S OPINION OF PROBABLE COST

PROJECT	Fort Riley Feasibility Study for HVAC Upgrade	**SHEET**	1 OF 1
ENGINEER	E M C Engineers, Inc.	**DATE PREPARED**	24-May-95
	Denver, CO	**ESTIMATOR**	C. Wohlert
		CHECKED BY	A. Niemeyer

Line No.	Item Refer Code	Item Description	Unit of Measure	MATERIAL COST Quantity	MATERIAL COST Unit Cost	MATERIAL COST Total	LABOR COST Crew/ Worker	LABOR COST Hours/ Unit	LABOR COST Total	TOTAL
1		**BUILDING 7804 and 7856 (each)**								
2		**NON-RECURRING**								
3										
4		*BASELINE - EXISTING EQUIP. REPLACEMENT*								
5	BOIL6.97	CAST IRON STEAM BOILER, 6.97 MBH	EA.	1.0	$51,357	$51,357	Q-7	400	$8,222	$59,579
6	STLPIP6	STEEL PIPE SCH. 40, 6" W/HANGERS	L.F.	25.0	$17.93	$448	Q-16	0.667	$362	$810
7		FITTINGS, 10%				$45			$36	$81
8	INSLPIP6	6" FIBERGLASS PIPE INSULATION, 1.5" THCK	L.F.	25.0	$2.18	$55	Q-14	0.145	$67	$121
9										
10										
11										
12										
13										
14										
15										
16										
17										
18										
19										
20										
21		*EXISTING SYSTEMS DEMOLITION*								
22		BOILER DEMOLITION	EA.	1.0			Q-6	275	$5,529	$5,529
23										
24										
25										
26										
27										
28										
29										
30										
31		**SUBTOTAL**				$51,904			$14,216	$66,121
32	OH	OVERHEAD			17%	$8,720			$2,388	$11,108
33	PRO	PROFIT			10%	$6,062			$1,660	$7,723
34	CONT	CONTINGENCY			20%	$13,337			$3,653	$16,990
35	**TOTAL COST**		-	-	-	$80,024	-	-	$21,918	$101,942

EVALUATION OF DEDICATED BOILERS FOR SERVICE WATER AND SPACE HEATING - BUILDING 7245 (DINING FACILITY)

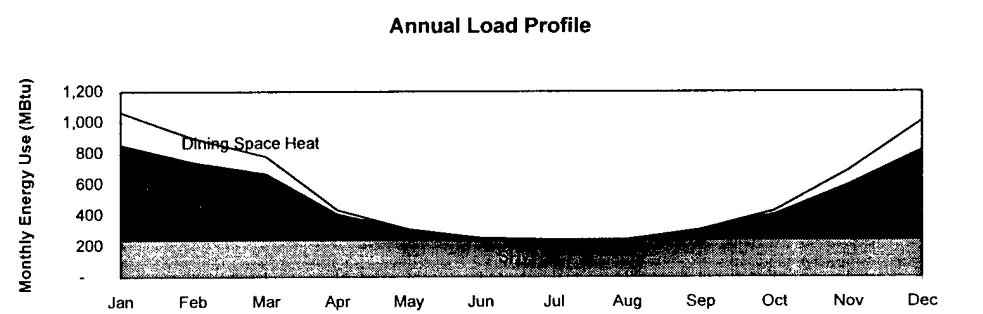
Equipment	Units	Btuh	MBtu/yr	Notes
Steam kettles (10 qrt)	2	18,447	56	5405 watts, 8.25 hrs/day
DHW Converter	1	1,626,300	2,849	1000 people, 3000 meals, 1.5 gal/hr/meal, 50 to 180 F, 2.4 gal/day/meal
Kitchen MAU Units	2	1,099,000	2,943	From baseline computer simulation
Dining AHUs	2	-		
HW Baseboard Converter	1	454,000	819	From baseline computer simulation
Total		3,197,747	6,667	

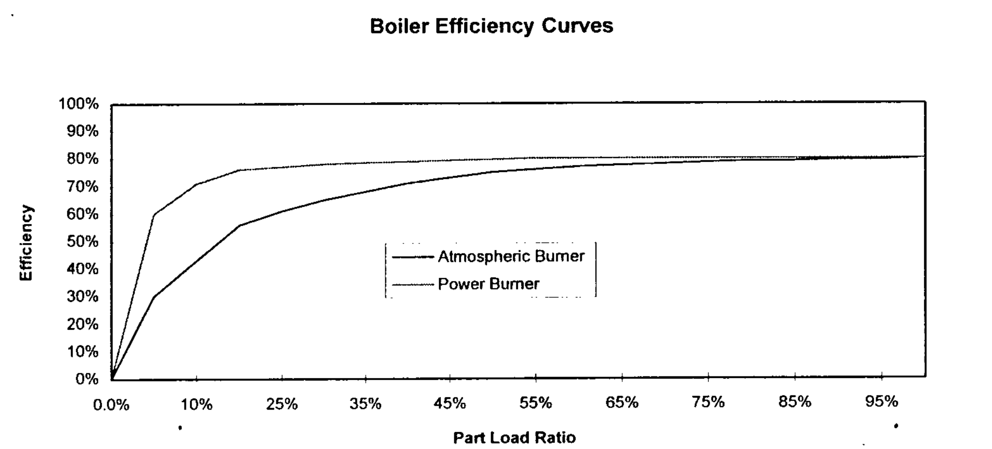
Total DHW & Steam kettlesKitchen	1,644,747	2,905
Total Space Heating	1,553,000	3,762

Existing Steam Boiler	6,900,000	Output

Boiler Efficiency Curve

% Full Load	Atm Burner Efficiency	Power Burner Efficiency
0.0%	0.0%	0.0%
2.5%	20.0%	40.0%
5%	30.0%	60.0%
10%	43.0%	71.0%
15%	50.0%	73.5%
20%	56.0%	76.0%
25%	61.0%	77.0%
30%	65.0%	78.0%
35%	68.0%	78.4%
40%	71.0%	78.8%
45%	73.0%	79.2%
50%	75.0%	79.6%
55%	76.0%	80.0%
60%	77.0%	80.0%
65%	77.5%	80.0%
70%	78.0%	80.0%
75%	78.5%	80.0%
80%	79.0%	80.0%
85%	79.0%	80.0%
90%	79.5%	80.0%
95%	79.5%	80.0%
100%	80.0%	80.0%





EVALUATION OF DEDICATED BOILERS FOR SERVICE WATER AND SPACE HEATING - BUILDING 7245 (DINING FACILITY)

Atmospheric Boiler

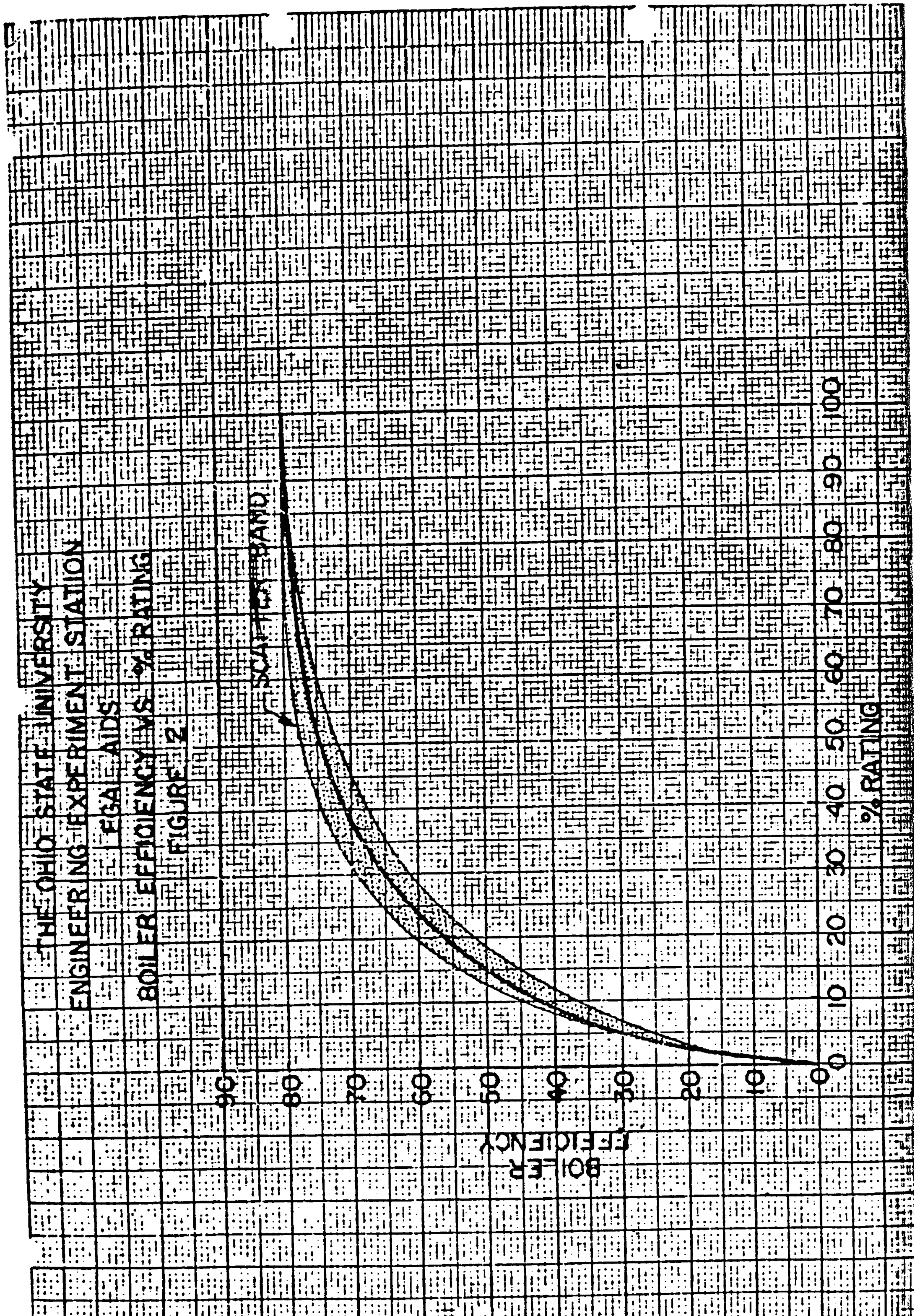
Load Profile

					Existing Boiler 6,900,000 Btuh			Proposed DHW Boiler 2,000,000 Btuh			Proposed Space Heat Boiler 2,000,000 Btuh			
Month	DHW (MBtu/mo)	Kitchen Space Heat (MBtu/mo)	Dining Space Heat (MBtu/mo)	Total (MBtu/mo)	% Full Load	Avg Boiler Efficiency	Boiler Energy Use (MBtu/mo)	% Full Load	Avg Boiler Efficiency	DHW Energy Use (MBtu/mo)	% Full Load	Avg Boiler Efficiency	DHW Energy Use (MBtu/mo	Total Energy Use (MBtu/mo)
Jan	242	613	211	1,066	21%	76%	1,403	17%	74%	329	57%	80%	1,030	1,359
Feb	242	500	156	898	18%	74%	1,222	17%	74%	329	46%	79%	828	1,158
Mar	242	425	113	780	16%	74%	1,061	17%	74%	329	37%	78%	686	1,016
Apr	242	166	28	436	9%	60%	727	17%	74%	329	13%	71%	273	603
May	242	63	5	310	6%	60%	517	17%	74%	329	5%	40%	-	329
Jun	242	12	0	254	5%	60%	423	17%	74%	329	1%	0%	-	329
Jul	242	1	0	243	5%	40%	608	17%	74%	329	0%	0%	-	329
Aug	242	2	0	244	5%	40%	610	17%	74%	329	0%	0%	-	329
Sep	242	66	0	308	6%	60%	513	17%	74%	329	5%	40%	-	329
Oct	242	164	24	430	9%	60%	717	17%	74%	329	13%	71%	265	594
Nov	242	354	93	689	14%	71%	971	17%	74%	329	31%	78%	573	902
Dec	242	579	189	1,010	20%	76%	1,329	17%	74%	329	53%	80%	965	1,294
Year	2,905	2,945	819	6,669			10,101			3,952			4,620	8,573

Power Burner Boiler

Load Profile

					Existing Boiler 6,900,000 Btuh			Proposed DHW Boiler 2,000,000 Btuh			Proposed Space Heat Boiler 2,000,000 Btuh			
Month	DHW (MBtu/mo)	Kitchen Space Heat (MBtu/mo)	Dining Space Heat (MBtu/mo)	Total (MBtu/mo)	% Full Load	Avg Boiler Efficiency	Boiler Energy Use (MBtu/mo)	% Full Load	Avg Boiler Efficiency	DHW Energy Use (MBtu/mo)	% Full Load	Avg Boiler Efficiency	DHW Energy Use (MBtu/mo	Total Energy Use (MBtu/mo)
Jan	242	613	211	1,066	21%	56%	1,904	17%	74%	329	57%	80%	1,030	1,359
Feb	242	500	156	898	18%	50%	1,796	17%	74%	329	46%	79%	828	1,158
Mar	242	425	113	780	16%	50%	1,560	17%	74%	329	37%	78%	686	1,016
Apr	242	166	28	436	9%	30%	1,454	17%	74%	329	13%	71%	273	603
May	242	63	5	310	6%	30%	1,034	17%	74%	329	5%	40%	-	329
Jun	242	12	0	254	5%	30%	847	17%	74%	329	1%	0%	-	329
Jul	242	1	0	243	5%	20%	1,215	17%	74%	329	0%	0%	-	329
Aug	242	2	0	244	5%	20%	1,220	17%	74%	329	0%	0%	-	329
Sep	242	66	0	308	6%	30%	1,027	17%	74%	329	5%	40%	-	329
Oct	242	164	24	430	9%	30%	1,434	17%	74%	329	13%	71%	265	594
Nov	242	354	93	689	14%	43%	1,602	17%	74%	329	31%	78%	573	902
Dec	242	579	189	1,010	20%	56%	1,804	17%	74%	329	53%	80%	965	1,294
Year	2,905	2,945	819	6,669			16,896			3,952			4,620	8,573



THE OHIO STATE UNIVERSITY
ENGINEERING EXPERIMENT STATION
FGA AIDS
BOILER EFFICIENCY VS. % RATING
FIGURE 2
SCATTER BAND
BOILER EFFICIENCY
90
80
70
60
50
40
30
20
10
0
10
20
30
40
50
60
70
80
90
100
% RATING

QUOTATION

INDUSTRIAL - DENVER COMPANY
PROFESSIONAL SALES ENGINEERS • MANUFACTURERS' AGENTS
5717 WEST 6TH AVENUE • DENVER, COLORADO 80214
PHONE: (303) 232-2664 • FAX (303) 237-9692

QUOTE NO. BUDGET

Date 3-7-95

TO: EMC ENGINEERS
ATTN: DENNIS JONES

SUBJECT Fort Riley
Manhattan, KS

ITEM	QUANTITY	DESCRIPTION	PRICE	EXTENSION
1	1	Bryan AB250S-15-FDG with National Board, ASME CSD-1		$15,640.00
2	1	Bryan HECL240W-60-FDG with National Board, ASME CSD-1		$16,110.00

Budget #
~~Final Cost TBD~~
Upon Receipt of
SPECS. & DRWGS.

NOTES

FREIGHT FFA

TOTAL

This quotation is subject to the terms and conditions printed on the reverse side of this page.

INDUSTRIAL DENVER COMPANY

Carl Dahlberg

Accepted for Purchaser ______ 19____

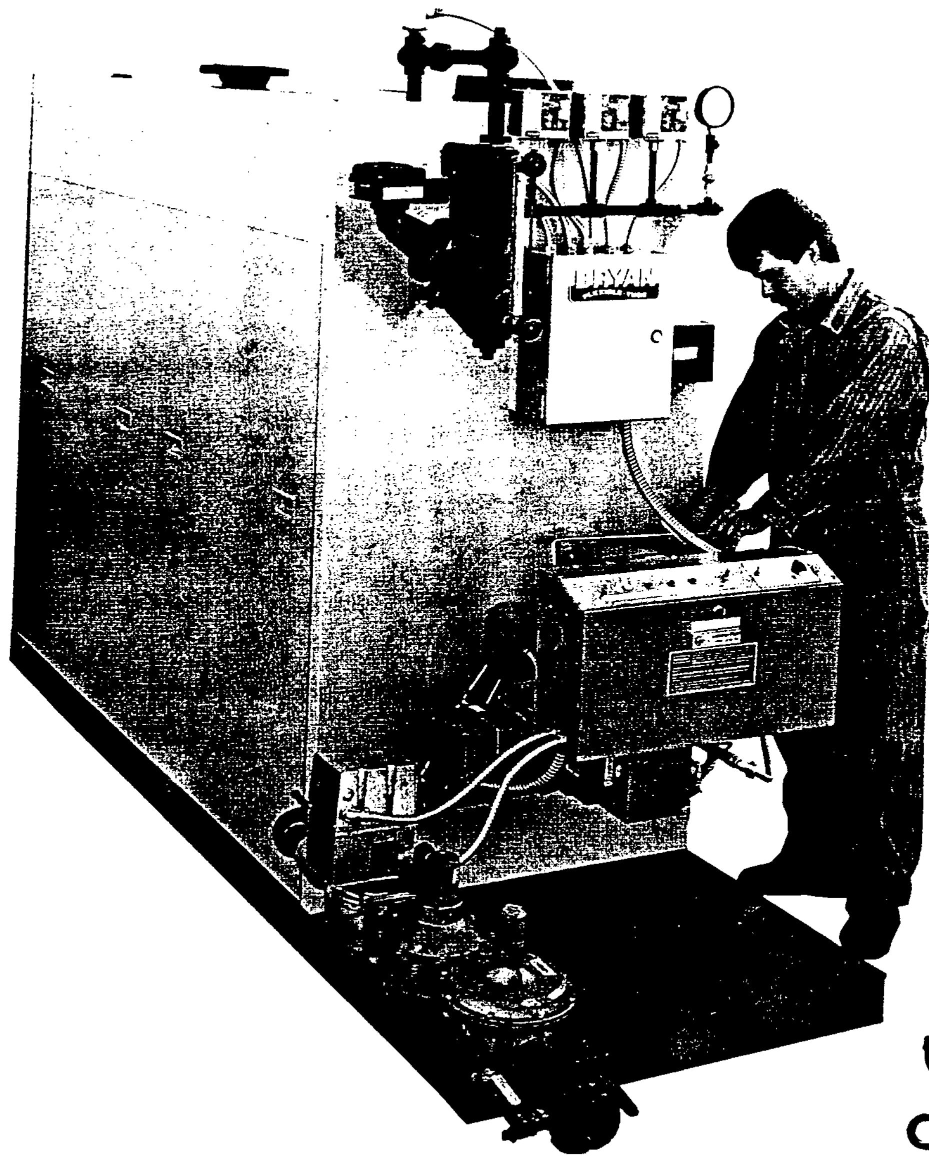
D7-52

(Name of Purchaser)

Form No. 750
(Rev. 2/

Forced Draft Gas, Oil or Dual Fuel Fired
Water Tube Boilers

AB Series — Steam
900,000 to 2,500,000 BTUH
21 HP through 60 HP
15 psi to 150 psi



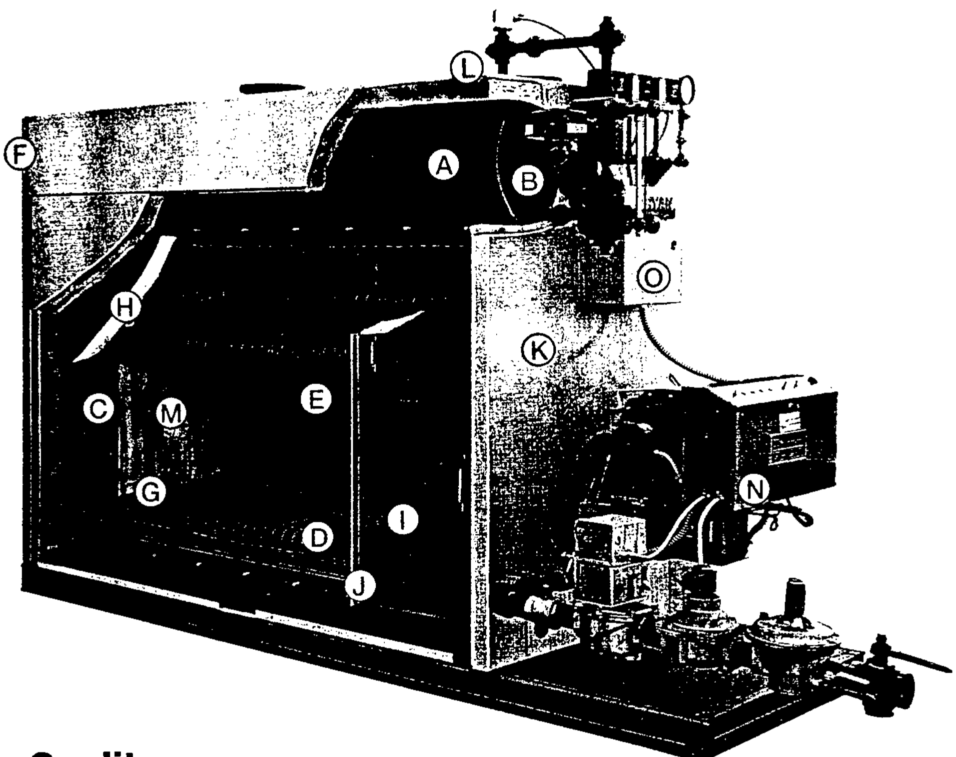
BRYAN BOILERS™

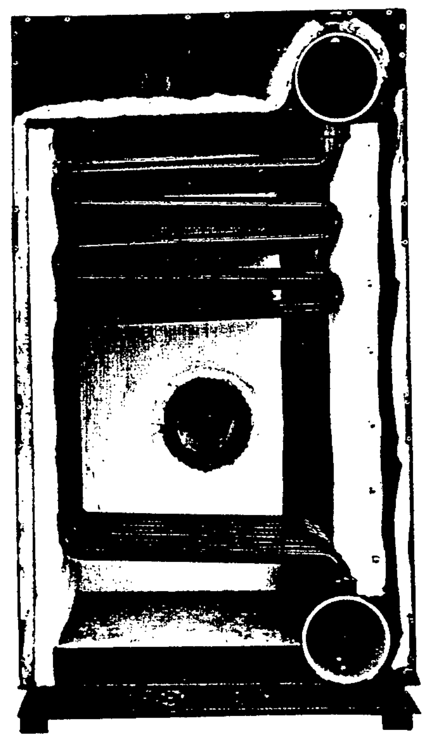
Featuring the exclusive Bryan "Flexible Water Tube" design

Performance efficiency breakthrough for commercial/industrial steam boilers

High efficiency steam heat guaranteed Featuring Bryan's "flexible water tube" design

- **True bent water tube**
- **Pressurized firing for high efficiency**
- **High quality steam for heat or process**
- **Full 5 sq ft per BHP heating surface area**





Quality Construction Features

A Heavy steel boiler frame, built and stamped in accordance with the appropriate ASME Boiler Code.

B Extra large drum with high steam release area ensures stable water level and dry steam.

C Large volume water leg downcomers promote rapid internal circulation for efficient heat transfer.

D Bryan bent water tubes are flexible, individually replaceable without welding or rolling.

E Water cooled furnace with low heat release.

F Water and steam side interior accessible for cleanout and inspection, front and rear openings, upper and lower drum.

G Pressurized design: Inner fireside casing constructed of heavy gauge steel, completely seal welded, lined with high temperature insulation and refractory.

H Boiler tube and furnace area access panels; Heavy gauge steel lined with high temperature insulation and refractory, bolted and tightly sealed to boiler frame.

I Access panel: Front panels provide easy access for inspection, cleaning and access to burner head.

J Single side access: Combustion chamber, tubes and burner head are completely accessible from one side, simplifying maintenance, minimizing floor space.

K Heavy gauge steel boiler jacket with rust resistant zinc coating and enamel finish. Insulated with fiberglass to ensure exceptionally cool outer surface.

L Minimum sized flue vent.

M Rear flame observation port.

N Forced draft, flame retention head type burner. Efficient combustion of oil or gas, quiet operation.

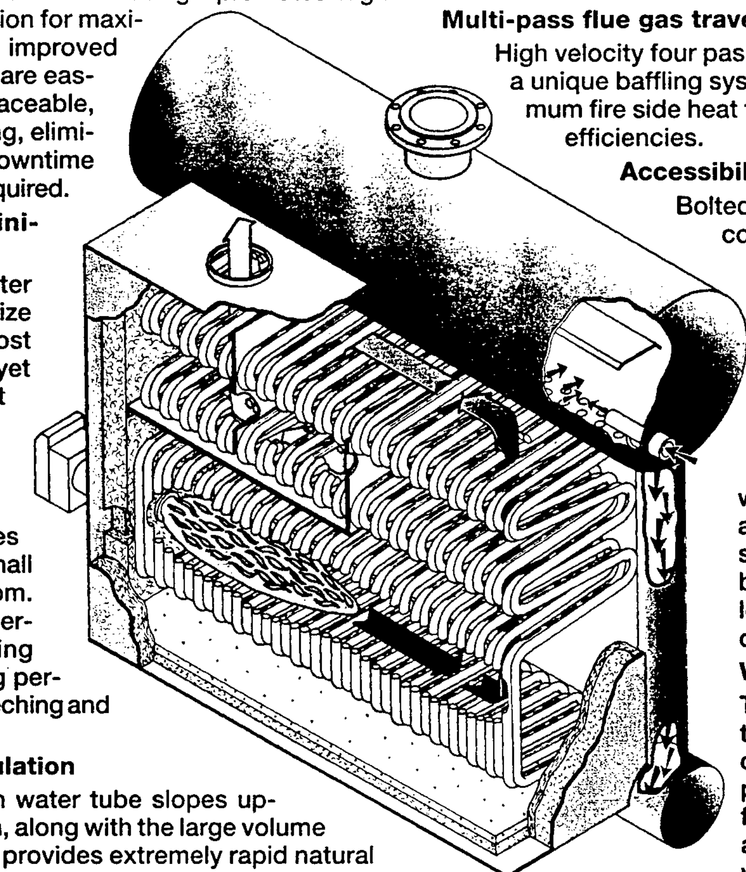
O Control panel: All controls installed and connected to terminal strip.

These unique features are available only on Bryan AB Series steam boilers

The Bryan Flexible Tube
Bryan's exclusive "flexible tube" design promotes high velocity internal circulation for maximum heat transfer and improved boiler efficiency. Tubes are easily removable and replaceable, without welding or rolling, eliminating long, expensive downtime should repairs ever be required.

Compact design, minimum floor space
With our compact water tube design, the overall size of the unit is less than most other types of boilers, yet provides a full five sq ft per BHP heating surface area. Needing only 25 inches for tube removal, and only on one side of the boiler, the AB Series boiler occupies very small space in the boiler room. This can result in considerable savings in building costs. Pressurized firing permits minimum sized breeching and vent.

Positive internal circulation
Each pass of the Bryan water tube slopes upward. This configuration, along with the large volume downcomer water legs, provides extremely rapid natural thermal internal circulation, promoting both high efficiency of heat transfer and uniform temperature throughout the boiler.



Multi-pass flue gas travel
High velocity four pass flue gas travel is obtained by a unique baffling system. This contributes to maximum fire side heat transfer and overall high boiler efficiencies.

Accessibility of furnace and tube area
Bolted inner panel provides easy and complete access to furnace and boiler tube area, as well as to burner head. Tube side panels are all removable and heavily insulated and sealed to boiler frame. All access is from only one side.

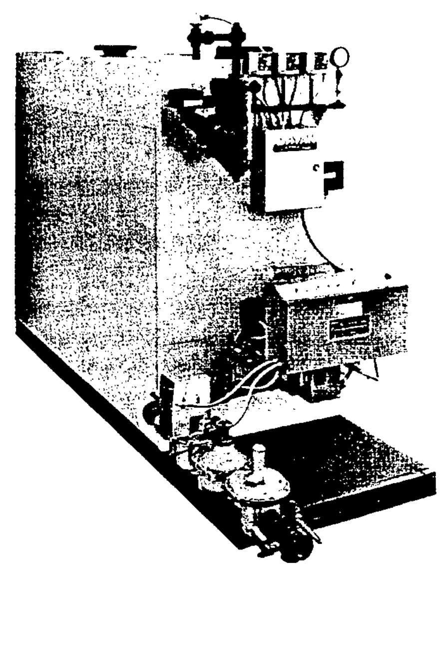
Large steam drum
The steam drum has generous water volume and steam release area. This design, along with specially engineered steam baffles, results in a stable water level and produces extremely dry steam at all load conditions.

Water cooled furnace
The configuration of the water tubes provides a water cooled combustion chamber. A high percentage of the heating surface is exposed to direct radiant heat, increasing water velocities and heat transfer.

Select a model to precisely meet your needs

Boiler Model	Input MBH (kW)	Steam Output Pounds per Hour*	Nominal Boiler Horsepower**
AB-90-S	900 (263.7)	742	22
AB-120-S	1200 (351.6)	989	30
AB-150-S	1500 (439.5)	1237	37
AB-200-S	2000 (586)	1649	49
AB-250-S	2500 (732.5)	2061	62

* from and at 212°F
** Natural gas, low pressure

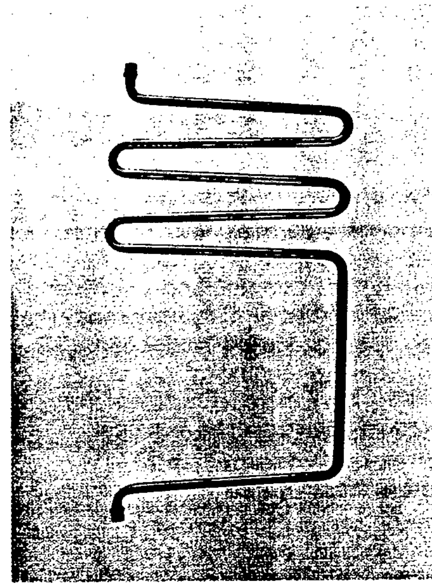


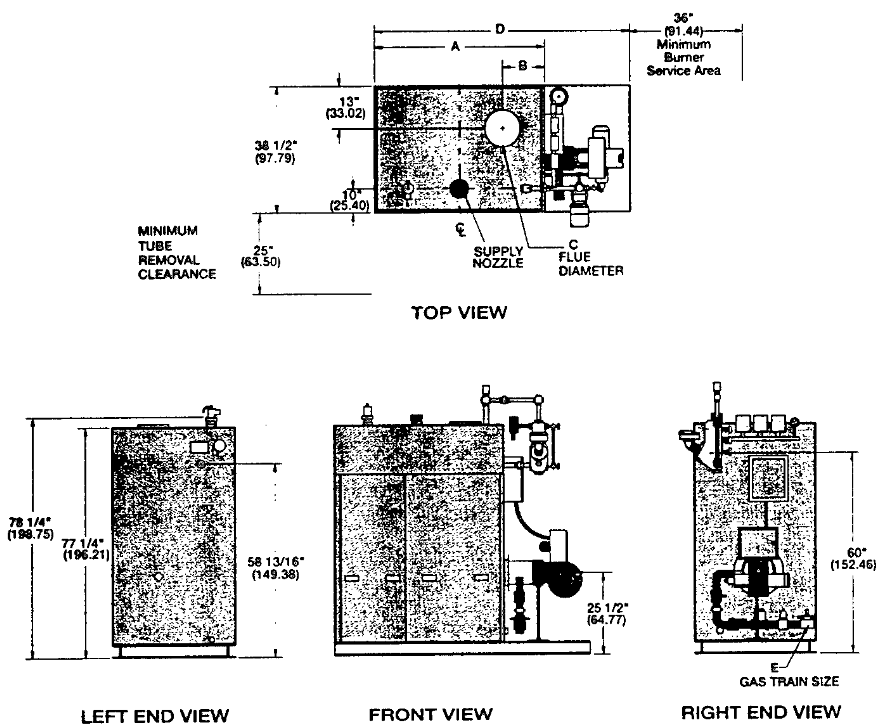
Bryan flexible water tube boilers are ideally suited for a wide range of commercial and industrial uses, space heating and process applications.
Note: Boilers are not approved for installation on combustible floors.

The Bryan "Flexible Water Tube" Story

Bryan Steam Corporation is proud of its history of developing and producing the original "Flexible Tube" boiler. During nine decades beginning in 1916 over five million of these tubes have been installed. The shape of this design gives the tube resilience and a natural upward flow which combine to deliver its unique benefits in Bryan boilers.

- Promotes rapid internal water circulation for efficient heat transfer
- Is easily replaced or removed without welding or rolling
- Requires a minimum of service space





Dimensions for AB Series Forced Draft Steam Boiler

Boiler Model	AB 90	AB 120	AB 150	AB 200	AB 250
A-Length over Jacket	44" (111.76)	53" (134.62)	62½" (158.75)	78" (198.12)	93" (237.49)
B-Flue Location	13½" (34.29)	13½" (34.29)	17½" (44.45)	17½" (44.45)	17½" (44.45)
C-Flue Diameter	10" (25.40)	10" (25.40)	10" (25.40)	10" (25.40)	12" (30.48)
D-Overall Length	76" (193.04)	85⅜" (216.83)	94¾" (240.66)	110" (279.40)	125½" (318.77)
E-Gas Train Size	1¼" (3.18)	1¼" (3.18)	1¼" (3.18)	2" (5.08)	2" (5.08)

Specifications subject to change without notice. Consult factory to consult on other boiler options.

Standard Equipment Furnished

Forced draft – flame retention type burner (gas, oil or gas/oil), complete with the latest state-of-the-art programming and safety combustion controls, pressure gauge, operating limit safety control, low water cut-off, pump control, auxiliary probe type LWCO, ASME safety relief valve, all controls installed and wired.

Optional Equipment Available

Manual reset high limit pressure control, two stage or modulating firing controls, dual fuel gas burner (example: natural and propane), alarm bells, FM, IRI or other insurance-approved control systems, indicating lights as desired, condensate return and boiler feed systems, water softeners, boiler and control blow-down assembly, higher operating pressures and temperatures available, auxiliary electric steam superheaters to 700°F. Contact factory for additional options and special construction including low NO_x package.

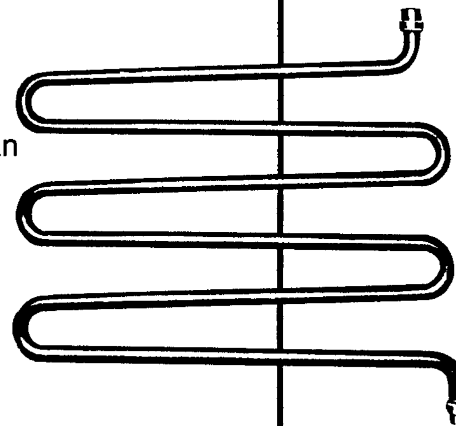
BRYAN STEAM CORPORATION™

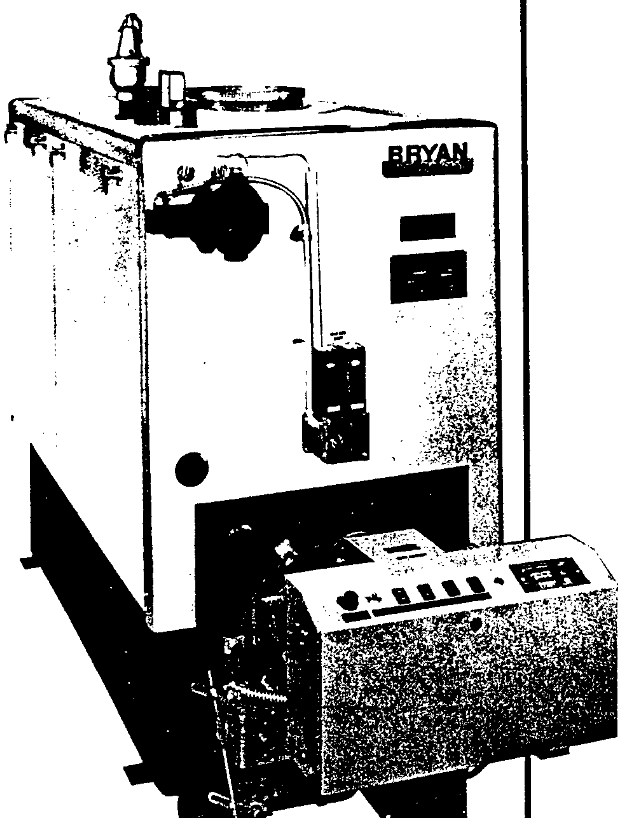
P.O. Box 27, Peru, Indiana 46970 Telephone: 317-473-6651
Fax: 317-473-3074

Printed in USA
14-1141

Forced Draft Gas
Bryan HECL Series Flexible Tube Boilers
Hot Water Heating 750,000 to 3,000,000 BTU's

HECL Series Boilers combine the time-proven Bryan Flexible Water Tube with an innovative heat extractor design.





Bryan Boilers are designed and built to the requirements of the appropriate A.S.M.E. boiler code. Boilers not approved for installation on combustible floor.

Guaranteed 85% efficiency

- **With HECL Series Boilers, you get a guaranteed 85% combustion efficiency resulting from a uniquely designed integrated extended surface heat extractor.**
- **What's more, HECL Boilers offer high operating efficiency—at all normal operation temperatures—without the complications of condensation concerns.**

Construction Features

1. Heavy steel boiler frame, built and stamped in accordance with the A.S.M.E. boiler code. Constructed as standard for hot water operating pressures to 60 psi.
2. Water leg downcomers to insure rapid internal circulation and temperature equalization.
3. Bryan bent water tubes, flexible, easily replaceable, requiring no welding or rolling.
4. Access panels, interior of boiler easily accessible for service and inspection.
5. Boiler tube access panel bolted tightly and sealed to boiler frame. Constructed of high temperature insulation board and steel framework. Tubes installed from one side.
6. Boiler frame insulated with 1-1/2" thick insulating refractory.
7. Boiler jacket, heavy gauge, zinc-coated, rust resistant primer and attractive enamel.
8. Flange mounted, gun type burner with flame retention head. Forced draft.
9. Lightweight, high temperature insulating fire brick combustion chamber--insulated from floor.
10. All controls installed and wired.

Specifications

	Firing Rate	Gross Output		Net Load Recommendation (EDR)		
BOILER MODEL NUMBER	BTU's Per Hour	BTU's Per Hour	Boiler Horse-Power	BTU's Per Hour	Hot Water Radiation Sq Ft	Approx. Shipping Weight
HECL-75	750,000	637,500	19	554,000	3,690	1,830
HECL-90	900,000	765,000	23	665,000	4,430	2,150
HECL-120	1,200,000	1,020,000	30	887,000	5,910	2,400
HECL-150	1,500,000	1,275,000	38	1,109,000	7,390	2,700
HECL-180	1,800,000	1,530,000	46	1,330,000	8,870	3,000
HECL-210	2,100,000	1,785,000	53	1,552,000	10,350	3,400
HECL-240	2,400,000	2,040,000	61	1,774,000	11,830	3,600
HECL-270	2,700,000	2,295,000	69	1,996,000	13,310	3,900
HECL-300	3,000,000	2,550,000	76	2,217,000	14,780	4,200

Bryan HECL Series Gas Flexible Tube Boilers

Efficient Water Tube Design

The Bryan Flexible Water Tube provides for extremely fast internal circulation for maximum heat transfer and operating efficiency.

No "Thermal Shock"

The flexibility of the bent water tube design eliminates all possible damage from "Thermal Shock" and from stresses caused by poor or unequal internal circulation. This is particularly important with forced hot water heating systems designed for higher temperatures and greater temperature drops.

Natural Internal Circulation

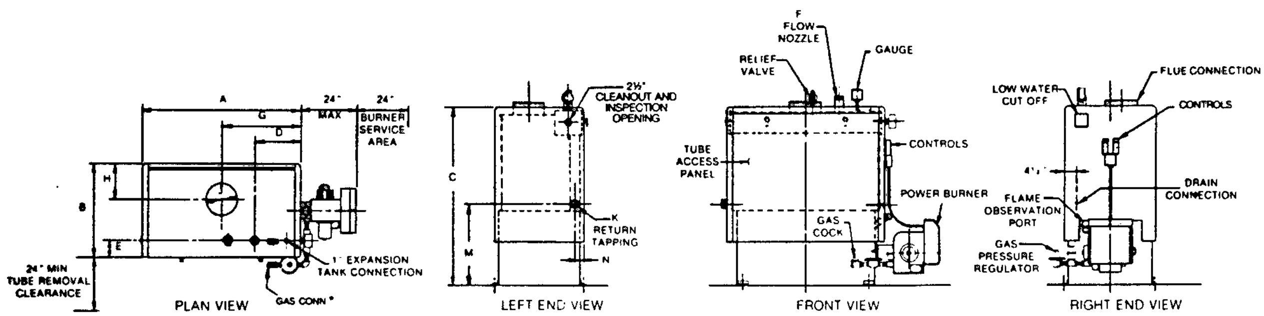
The water tube design and the large downcomer water legs provide adequate internal circulation without concern over exterior pumping conditions. Low pressure drop through boiler.

Compact—Minimum Floor Space

Requires less floor space than most boilers—minimum boiler room size.

Shipped completely assembled and wired.

Tubes are easily removable and replaceable, requiring little service space.



DIMENSIONS (in inches)													
BOILER MODEL	Length Over Jacket	Width Over Jacket	Height Over Jacket	Location of Flow Nozzle or Tapping		Flow Nozzle Or Tapping NPT	Location of Flue Connection		Flue Diameter	Return Tapping NPT	Location of Return Tapping	
	A	B	C	D	E	F	G	H	J	K	M	N
HECL-75	36¼	34½	66½	17	6¼	3	18⅛	16	8	3	30¼	4½
HECL-90	41½	34½	66½	17	6¼	3	20¾	15	10	3	30¼	4½
HECL-120	50¾	34½	66½	17	6¼	3	25⅜	14	10	3	30¼	4½
HECL-150	59¾	34½	66½	17	6¼	3	29⅞	13	12	3	30¼	4½
HECL-180	69	34½	66½	17	6¼	3	34½	12	14	3	30¼	4½
HECL-210	78¼	34½	66½	17	6¼	3	39⅛	12	14	3	30¼	4½
HECL-240	87½	34½	66½	17	6¼	3	43¾	11	16	3	30¼	4½
HECL-270	96¾	34½	66½	17	6¼	3	48⅜	11	16	3	30¼	4½
HECL-300	106	34½	66½	17	6¼	3	53	11	16	3	30¼	4½

*Gas train and control location dimensions will vary depending on job specifications and conditions.
NOTE: Dimensions and specifications are subject to change without notice. Consult factory for certified dimensions.

Standard Equipment

Forced draft construction, combination thermometer and altitude gauge, A.S.M.E. rated relief valve, combustion safety control, high limit control, low water cut-off, built-in combustion chamber, flange-mounted burner, electronic combustion safety control, water temperature control (240° max. std.) heavy gauge jacket with 1½" insulation. All controls mounted and wired.

Optional Equipment

1. Combination water feeder and low water cut-off.
2. Induced draft fan.

When ordering, please specify

(1) Electric power voltage and frequency (115v-60Hz is std.)
(2) Relief valve setting.
(3) Optional equipment or special features.

BRYAN STEAM CORPORATION
P.O. Box 27, Peru, Indiana 46970 / Telephone: 317-473-6651
FAX: 317-473-3074

Form No. 6700-3

Printed in USA
72-4836

BUILDING 741
ANNUAL ENERGY SAVINGS SUMMARY

Item	Baseline	ECO	Annual Energy Savings	Adj. Annual Energy Savings*
Annual Electric (MBTU)	184.55	131.11	53.44	213.45
Annual Natural Gas (MBTU)	1010.13	853.47	156.66	625.73
Electric Demand June (KW)	14.26	14.26	0.00	0.00
Electric Demand July (KW)	14.26	14.26	0.00	0.00
Electric Demand August (KW)	14.26	14.26	0.00	0.00

*Energy savings prorated on a square foot basis:

Baseline Model Bldg 8300 (sq.ft.)	8640
ECO Model Bldg 741 (sq.ft.)	34510
Square Footage Adjustment Factor	3.994

LIFE CYCLE COST ANALYSIS SUMMARY
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

LOCATION:	Fort Riley	REGION: 2 (Kansas)		PROJECT NO:	1406-005
PROJECT TITLE:	Feasibility Study for HVAC Upgrade			FISCAL YEAR:	1995
ANALYSIS DATE:	05/04/95	ECONOMIC LIFE:	20	PREPARED BY:	C. Wohlert

1. INVESTMENT: **BLDG 741 - Replace STM UHs w/ Gas-fired Infrared Tube Heating System**

A.	CONSTRUCTION COST	=	$145,945	
B.	SIOH COST	(5.5% of 1A) =	$8,027	
C.	DESIGN COST	(6.0% of 1A) =	$8,757	
D.	TOTAL COST	(1A +1B +1C) =	$162,728	
E.	SALVAGE VALUE OF EXISTING EQUIPMENT =		$20,500	
F.	PUBLIC UTILITY COMPANY REBATE =		$0	
G.	TOTAL INVESTMENT	(1D -1E -1F) =	------->	$142,228

2. ENERGY SAVINGS (+) OR COST (-):

DATE OF NISTR 85-3273-9 USED FOR DISCOUNT FACTORS: JAN '95

	ENERGY SOURCE	FUEL COST $/MBTU (1)	SAVINGS MBTU/YR (2)	ANNUAL $ SAVINGS (3)	DISCOUNT FACTOR (4)	DISCOUNTED SAVINGS (5)	
A.	ELECT.	$12.10	213	$2,583	15.88	$41,014	
B.	DIST	$0.00	0	$0	19.16	$0	
C.	NAT GAS	$4.12	626	$2,578	18.30	$47,178	
D.	COAL	$0.00	0	$0	16.62	$0	
E.	ELEC. DEMAND			$0	14.88	$0	
F.	TOTAL		839	$5,161		-------->	$88,192

3. NON-ENERGY SAVINGS (+) OR COST (-)

A. ANNUAL RECURRING (+/-)

1 ANNUAL MAINTENANCE	$600	14.88	$8,921
2	$0	14.88	$0
3	$0	14.88	$0
4 TOTAL ANNUAL DISC. SAVINGS (+) / COST	$600		$8,921

B. NON-RECURRING (+/-)

ITEM	SAVINGS (+) COST(-) (1)	YEAR OF OCCURRENCE (2)	DISCOUNT FACTOR (3) (TABLE A-2)	DISCOUNTED SAVINGS/COST (4)
a. BASELINE EQUIP. REPLACEMEN	$63,690	5	0.863	$54,964
b.				$0
c.				$0
d.				$0
e.				$0
f. TOTAL	$63,690			$54,964

C. TOTAL NON-ENERGY DISCOUNTED SAVINGS (+) OR COST (-) (3A4 + 3Bf4) = $63,885

4.	FIRST YEAR DOLLAR SAVINGS (+) / COSTS (-)	(2F3+3A4+(3Bf1/Economic Life))	$8,945
5.	SIMPLE PAYBACK (SPB) IN YEARS (MUST BE < 10 YEARS TO QUALIFY)	(1G/4) =	15.90
6.	TOTAL NET DISCOUNTED SAVINGS	(2F5 + 3C) =	$152,077
7.	DISCOUNTED SAVINGS-TO-INVESTMENT RATIO (SIR) (MUST HAVE SIR > 1.25 TO QUALIFY)	(6/1G) =	1.07

ENGINEER'S OPINION OF PROBABLE COST

PROJECT	Fort Riley Feasibility Study for HVAC Upgrade	**SHEET** 1	**OF** 1
ENGINEER	E M C Engineers, Inc. Denver, CO	**DATE PREPARED**	4-May-95
		ESTIMATOR	C. Wohlert
		CHECKED BY	A. Niemeyer

Line No.	Item Refer Code	Item Description	Unit of Measure	MATERIAL COST Quantity	MATERIAL COST Unit Cost	MATERIAL COST Total	LABOR COST Crew/ Worker	LABOR COST Hours/ Unit	LABOR COST Total	TOTAL
1		**BUILDING 741**								
2		**PROPOSED SYSTEM MODIFICATIONS**								
3										
4		*NEW SYSTEMS INSTALLATION*								
5	STLPIP3	STEEL PIPE SCH. 40, 3" W/HANGERS	L.F.	50.0	$6.40	$320	Q-15	0.372	$361	$680
6	STLPIP2.5	STEEL PIPE SCH. 40, 2.5" W/HANGERS	L.F.	400.0	$5.28	$2,112	Q-15	0.34	$2,637	$4,749
7	STLPIP1.2	STEEL PIPE SCH. 40, 1.25" W/HANGERS	L.F.	375.0	$2.56	$959	Q-1	0.2	$1,454	$2,414
8	STLPIP1	STEEL PIPE SCH. 40, 1" W/HANGERS	L.F.	65.0	$2.10	$137	Q-1	0.151	$190	$327
9	GASCN	FLEXIBLE CONNECTOR 12" LONG	EA.	40.0	$7.90	$316	1-PLUM	0.222	$191	$507
10	IRHEAT	GAS FIRED IR TUBE SYSTEMS / BURNER	EA.	36.0	$1,564.94	$56,338	Q-6	18.24	$13,202	$69,540
11	ELCND1	ELECTRICAL CONDUIT 1"	L.F.	850.0	$0.83	$708	1-ELEC	0.064	$1,138	$1,847
12	WIRE#6	COPPER WIRING #6	C.L.F.	8.5	$24.71	$210	1-ELEC	1.231	$219	$429
13	FURN150	PULSE COMB FURNACE 150,000 BTUH	EA.	2.0	$2,713.20	$5,426	Q-10	28	$1,088	$6,514
14	FURN125	PULSE COMB FURNACE 125,000 BTUH	EA.	1.0	$2,422.50	$2,423	Q-10	26	$505	$2,928
15	UH7	HORIZ. UNIT HEATER, PROPELLER, 87.6 MBH	EA.	1.0	$731.60	$732	Q-5	2.462	$48	$779
16										
17										
18										
19										
20										
21		*EXISTING SYSTEMS DEMOLITION*								
22		BOILER DEMOLITION (Salv Value = $20,500)	EA.	1.0			Q-6	150	$3,016	$3,016
23		UNIT HEATER & BASEBOARD DEMO	TON	3.3			Q-5	14.545	$931	$931
24										
25										
26										
27										
28										
29										
30										
31		**SUBTOTAL**				$69,681			$24,981	$94,661
32	OH	OVERHEAD			17%	$11,706			$4,197	$15,903
33	PRO	PROFIT			10%	$8,139			$2,918	$11,056
34	CONT	CONTINGENCY			20%	$17,905			$6,419	$24,324
35	**TOTAL COST**		-	-	-	$107,431	-	-	$38,514	$145,945

ENGINEER'S OPINION OF PROBABLE COST

PROJECT	Fort Riley Feasibility Study for HVAC Upgrade	**SHEET**	1 OF 1
ENGINEER	E M C Engineers, Inc.	**DATE PREPARED**	4-May-95
	Denver, CO	**ESTIMATOR**	C. Wohlert
		CHECKED BY	A. Niemeyer

Line No.	Item Refer Code	Item Description	Unit of Measure	MATERIAL COST Quantity	MATERIAL COST Unit Cost	MATERIAL COST Total	LABOR COST Crew/ Worker	LABOR COST Hours/ Unit	LABOR COST Total	TOTAL
1		**BUILDING 741**								
2		**NON-RECURRING**								
3										
4		*BASELINE - EXISTING EQUIP. REPLACEMENT*								
5	AHU14000	14,000 CFM AHU, HEATING ONLY	EA.	4.0	$6,492.30	$25,969	Q-6	57.143	$4,596	$30,565
6	DUCT100	GAL. STEEL DUCTWORK, 500 TO 1000 LB.	LB.	800.0	$0.47	$372	Q-10	0.094	$1,461	$1,833
7	STLPIP1.5	STEEL PIPE SCH. 40, 1.5" W/HANGERS	L.F.	120.0	$2.95	$353	Q-1	0.2	$465	$819
8	UH7	HORIZ. UNIT HEATER, PROPELLER, 87.6 MBH	EA.	4.0	$731.60	$2,926	Q-5	2.462	$191	$3,117
9	BBRD36	CAST IRON RADIATOR, 36.5 MBH	EA.	4.0	$605.63	$2,423	Q-5	2	$155	$2,578
10	STLPIP1	STEEL PIPE SCH. 40, 1" W/HANGERS	L.F.	80.0	$2.10	$168	Q-1	0.151	$234	$402
11	INSLPIP1	1" FIBERGLASS PIPE INSULATION, 1" THCK	L.F.	80.0	$0.62	$50	Q-14	0.073	$108	$157
12	INSLPIP1.	1.25" FIBERGLASS PIPE INSULATION, 1.5" THCK	L.F.	120.0	$1.40	$167	Q-14	0.08	$177	$344
13										
14										
15										
16										
17										
18										
19										
20		*EXISTING SYSTEMS DEMOLITION*								
21		AHU DEMOLITION	TON	1.8			Q-6	12	$434	$434
22		UNIT HEATER & BASEBOARD DEMO	TON	3.3			Q-5	14.545	$931	$931
23		PIPING DEMOLITION	L.F.	200.0			PLUM	0.04	$129	$129
24										
25										
26										
27										
28										
29										
30										
31		**SUBTOTAL**				$32,429			$8,881	$41,310
32	OH	OVERHEAD			17%	$5,448			$1,492	$6,940
33	PRO	PROFIT			10%	$3,788			$1,037	$4,825
34	CONT	CONTINGENCY			20%	$8,333			$2,282	$10,615
35	**TOTAL COST**		-	-	-	$49,998	-	-	$13,692	$63,690

ENGINEER'S OPINION OF PROBABLE COST

PROJECT	Fort Riley Feasibility Study for HVAC Upgrade	SHEET 1 OF 1	
ENGINEER	E M C Engineers, Inc.	DATE PREPARED	4-May-95
	Denver, CO	ESTIMATOR	C. Wohlert
		CHECKED BY	A. Niemeyer

Line No.	Item Refer Code	Item Description	Unit of Measure	MATERIAL COST Quantity	MATERIAL COST Unit Cost	MATERIAL COST Total	LABOR COST Crew/ Worker	LABOR COST Hours/ Unit	LABOR COST Total	TOTAL
1		**BUILDING 741**								
2		***ANNUAL RECURRING***								
3		***ANNUAL MAINTENANCE COST - BASELINE***								
4	MNT-BLR	MAINT. ON BOILERS - >2.5 MBH	EA.	1.0	$96.90	$97	Q-6	25	$503	$600
5	MNT-UH	MAINT. ON UHS - INSPEC. / YR	EA.	15.0			Q-6	4	$1,206	$1,206
6	MNT-AHU	MAINT. ON AHU - INSPEC. / YR > 5000 CFM	EA.	4.0	$0.00	$0	Q-6	25	$2,011	$2,011
7										
8										
9										
10										
11										
12										
13										
14										
15	**TOTAL ANNUAL MAINTENANCE COST - BASELINE**		-	-	-	$97	-	-	$3,720	$3,816
16										
17		***ANNUAL MAINTENANCE COST - NEW HVAC REPLACEMENT***								
18										
19	MNT-IR	MAINT. ON IR HEATERS - INSPEC. / YR	EA.	36.0			Q-6	4	$2,895	$2,895
20	MNT-FAC	MAINT. ON FAC - INSPEC. / YR	EA.	3.0	$0.00	$0	Q-6	4	$241	$241
21	MNT-UH	MAINT. ON UHS - INSPEC. / YR	EA.	1.0	$0.00	$0	Q-6	4	$80	$80
22										
23										
24										
25										
26										
27										
28										
29	**TOTAL ANNUAL MAINTENANCE COST - BASELINE**		-	-	-	$0	-	-	$3,217	$3,217
30										
31										
32										
33										
34										
35	**TOTAL ANNUAL MAINTENANCE COST SAVINGS**		-	-	-	$97	-	-	$503	$600

EMC ENGINEERS INC. EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/ 7/1995 13:23: 7 LDL RUN 1
DENVER, CO 80227 EXISTING CONDITION FOR BLDG. #~~7176~~ 741 VEHICAL MAINT BAY
REPORT- LV-D DETAILS OF EXTERIOR SURFACES IN THE PROJECT TOPEKA, KS

NUMBER OF EXTERIOR SURFACES 4 RECTANGULAR 4 OTHER 0
(U-VALUE INCLUDES INSIDE AIR FILM PLUS OUTSIDE AIR FILM AT 7.5 MPH WINDSPEED)

SURFACE	SPACE	- - - - G L A S S - - - - U-VALUE (BTU/HR-SQFT-F)	AREA (SQFT)	- - - - W A L L - - - - U-VALUE (BTU/HR-SQFT-F)	AREA (SQFT)	- W A L L + G L A S S - U-VALUE (BTU/HR-SQFT-F)	AREA (SQFT)	AZIMUTH
	BAY-AREA	0.000	0.00	0.133	3600.00	0.133	3600.00	NORTH-EAST
	BAY-AREA	0.490	56.00	0.133	3544.00	0.139	3600.00	SOUTH-WEST
	BAY-AREA	0.490	266.00	0.133	1234.00	0.196	1500.00	NORTH-WEST
	BAY-AREA	0.000	0.00	0.092	7440.00	0.092	7440.00	ROOF
	BAY-AREA	0.000	0.00	0.020	7440.00	0.020	7440.00	UNDERGRND

EMC ENGINEERS INC. EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/ 7/1995 13:23: 7 LDL RUN 1
DENVER, CO 80227 EXISTING CONDITION FOR BLDG. #7176 VEHICAL MAINT BAY
REPORT- LV-D DETAILS OF EXTERIOR SURFACES IN THE PROJECT TOPEKA, KS

D8-7

	AVERAGE U-VALUE/GLASS (BTU/HR-SQFT-F)	AVERAGE U-VALUE/WALLS (BTU/HR-SQFT-F)	AVERAGE U-VALUE WALLS+GLASS (BTU/HR-SQFT-F)	GLASS AREA (SQFT)	OPAQUE AREA (SQFT)	GLASS+OPAQUE AREA (SQFT)
NORTH-EAST	0.000	0.133	0.133	0.00	3600.00	3600.00
SOUTH-WEST	0.490	0.133	0.139	56.00	3544.00	3600.00
NORTH-WEST	0.490	0.133	0.196	266.00	1234.00	1500.00
ROOF	0.000	0.092	0.092	0.00	7440.00	7440.00
ALL WALLS	0.490	0.133	0.146	322.00	8378.00	8700.00
WALLS+ROOFS	0.490	0.114	0.121	322.00	15818.00	16140.00
UNDERGRND	0.000	0.020	0.020	0.00	7440.00	7440.00
BUILDING	0.490	0.084	0.089	322.00	23258.00	23580.00

EMC ENGINEERS INC. EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/ 7/1995 13:23: 7 LDL RUN 1
DENVER, CO 80227 EXISTING CONDITION FOR BLDG. #~~7176~~ 741 VEHICAL MAINT BAY
REPORT- LS-C BUILDING PEAK LOAD COMPONENTS TOPEKA, KS

*** BUILDING ***

FLOOR AREA	8640	SQFT	803	SQMT
VOLUME	216000	CUFT	6117	CUMT

	COOLING LOAD				HEATING LOAD	
TIME	SEP 6 4PM				DEC 8 1PM	
DRY-BULB TEMP	93F	34C			20F	-7C
WET-BULB TEMP	76F	24C			17F	-8C
	SENSIBLE		LATENT		SENSIBLE	
	(KBTU/H)	(KW)	(KBTU/H)	(KW)	(KBTU/H)	(KW)
WALLS	20.461	5.993	0.000	0.000	-33.326	-9.760
ROOFS	21.857	6.401	0.000	0.000	-30.484	-8.928
GLASS CONDUCTION	3.833	1.122	0.000	0.000	-7.984	-2.338
GLASS SOLAR	8.789	2.574	0.000	0.000	3.614	1.058
DOOR	19.780	5.793	0.000	0.000	-28.776	-8.428
INTERNAL SURFACES	0.000	0.000	0.000	0.000	0.000	0.000
UNDERGROUND SURFACES	-0.055	-0.016	0.000	0.000	-2.656	-0.778
OCCUPANTS TO SPACE	8.857	2.594	17.500	5.125	8.670	2.539
LIGHT TO SPACE	36.907	10.809	0.000	0.000	35.571	10.418
EQUIPMENT TO SPACE	0.000	0.000	0.000	0.000	0.000	0.000
PROCESS TO SPACE	0.000	0.000	0.000	0.000	0.000	0.000
INFILTRATION	507.805	148.723	647.265	189.568	-1265.722	-370.698
TOTAL	628.234	183.994	664.765	194.693	-1321.092	-386.915
TOTAL LOAD	1292.998 KBTU/H		378.687 KW		-1321.092 KBTU/H	-386.915 KW
TOTAL LOAD / AREA	149.65BTU/H.SQFT		471.777 W /SQMT		152.904BTU/H.SQFT	482.028 W /SQMT

NOTE 1)THE ABOVE LOADS EXCLUDE OUTSIDE VENTILATION AIR LOADS
2)TIMES GIVEN IN STANDARD TIME FOR THE LOCATION IN CONSIDERATION

EMC ENGINEERS INC. EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/ 7/1995 13:23: 7 SDL RUN 1
DENVER, CO 80227 EXISTING CONDITION FOR BLDG. ~~#7176~~ 741 VEHICAL MAINT BAY
REPORT- SS-A SYSTEM MONTHLY LOADS SUMMARY FOR UNIT-HEATS TOPEKA, KS

MONTH	COOLING ENERGY (MBTU)	COOLING TIME OF MAX DY	COOLING TIME OF MAX HR	COOLING DRY-BULB TEMP	COOLING WET-BULB TEMP	MAXIMUM COOLING LOAD (KBTU/HR)	HEATING ENERGY (MBTU)	HEATING TIME OF MAX DY	HEATING TIME OF MAX HR	HEATING DRY-BULB TEMP	HEATING WET-BULB TEMP	MAXIMUM HEATING LOAD (KBTU/HR)	ELECTRICAL ENERGY (KWH)	MAXIMUM ELEC LOAD (KW)
JAN	0.00000					0.000	-152.395	4	10	8.F	7.F	-1153.493	2975.	15.141
FEB	0.00000					0.000	-108.869	14	10	30.F	27.F	-972.041	2666.	15.141
MAR	0.00000					0.000	-94.123	3	9	17.F	13.F	-1117.751	3194.	15.141
APR	0.00000					0.000	-34.033	4	10	34.F	31.F	-860.876	2871.	15.030
MAY	0.00000					0.000	-5.651	4	17	55.F	53.F	-397.961	2847.	14.560
JUN	0.00000					0.000	0.000					0.000	2978.	14.250
JUL	0.00000					0.000	0.000					0.000	2708.	14.250
AUG	0.00000					0.000	0.000					0.000	3114.	14.250
SEP	0.00000					0.000	0.000					0.000	2843.	14.250
OCT	0.00000					0.000	-24.799	19	11	39.F	32.F	-750.751	2728.	14.920
NOV	0.00000					0.000	-64.337	1	15	36.F	28.F	-889.781	2762.	15.062
DEC	0.00000					0.000	-140.368	8	13	20.F	17.F	-1187.388	2964.	15.141
TOTAL	0.000						-624.576						34649.	
MAX						0.000						-1187.388		15.141

D8-9

EMC ENGINEERS INC. EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/ 7/1995 13:23: 7 SDL RUN 1
DENVER, CO 80227 EXISTING CONDITION FOR BLDG. #7176 VEHICAL MAINT BAY
REPORT- SS-C SYSTEM MONTHLY LOAD HOURS FOR UNIT-HEATS TOPEKA, KS

MONTH	HOURS COOLING LOAD	HOURS HEATING LOAD	HOURS COINCIDENT COOL-HEAT LOAD	HOURS FLOATING	HOURS HEATING AVAIL.	HOURS COOLING AVAIL.	HOURS FANS ON	HOURS FANS CYCLE ON	HOURS NIGHT VENTING	HOURS FLOATING WHEN FANS ON	COINCIDENT LOADS: HEATING LOAD AT COOLING PEAK (KBTU/HR)	COINCIDENT LOADS: ELECTRIC LOAD AT COOLING PEAK (KW)
JAN	0	384	0	360	744	0	384	384	0	0	-204.980	0.169
FEB	0	336	0	336	672	0	336	336	0	0	-203.837	0.169
MAR	0	370	0	374	744	0	370	370	0	0	-254.702	0.215
APR	0	231	0	489	720	0	278	278	0	47	-40.040	0.031
MAY	0	62	0	682	360	0	194	194	0	132	0.000	0.000
JUN	0	0	0	720	0	0	0	0	0	0	0.000	0.000
JUL	0	0	0	744	0	0	0	0	0	0	0.000	0.000
AUG	0	0	0	744	0	0	0	0	0	0	0.000	0.000
SEP	0	0	0	720	0	0	0	0	0	0	0.000	0.000
OCT	0	212	0	532	720	0	272	272	0	60	0.000	0.000
NOV	0	330	0	390	720	0	333	333	0	3	0.000	0.000
DEC	0	382	0	362	744	0	382	382	0	0	0.000	0.000
ANNUAL	0	2307	0	6453	5424	0	2549	2549	0	242		

EMC ENGINEERS INC. EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/ 7/1995 13:23: 7 PDL RUN 1
DENVER, CO 80227 EXISTING CONDITION FOR BLDG. ~~#7176~~ 741 VEHICAL MAINT BAY
REPORT- PS-B MONTHLY PEAK AND TOTAL ENERGY USE TOPEKA, KS

MO	UTILITY-	ELECTRICITY	NATURAL-GAS
	TOTAL(MBTU)	23.163	238.950
JAN	PEAK(KBTU)	88.871	1543.960
	DY/HR	27/16	4/10
	TOTAL(MBTU)	20.113	177.244
FEB	PEAK(KBTU)	88.871	1337.701
	DY/HR	14/10	14/10
	TOTAL(MBTU)	21.488	154.397
MAR	PEAK(KBTU)	88.871	1503.793
	DY/HR	3/11	3/ 9
	TOTAL(MBTU)	14.927	57.420
APR	PEAK(KBTU)	88.493	1208.451
	DY/HR	4/10	4/10
	TOTAL(MBTU)	10.891	9.920
MAY	PEAK(KBTU)	86.888	646.644
	DY/HR	4/11	4/17
	TOTAL(MBTU)	10.169	0.000
JUN	PEAK(KBTU)	48.656	0.000
	DY/HR	30/16	30/ 1
	TOTAL(MBTU)	9.245	0.000
JUL	PEAK(KBTU)	48.656	0.000
	DY/HR	29/16	31/ 1
	TOTAL(MBTU)	10.631	0.000
AUG	PEAK(KBTU)	48.656	0.000
	DY/HR	31/16	31/ 1
	TOTAL(MBTU)	9.707	0.000
SEP	PEAK(KBTU)	48.656	0.000
	DY/HR	30/16	30/ 1
	TOTAL(MBTU)	13.577	42.222
OCT	PEAK(KBTU)	88.116	1078.248
	DY/HR	19/11	19/11
	TOTAL(MBTU)	17.870	107.824
NOV	PEAK(KBTU)	88.604	1242.270
	DY/HR	1/15	1/15
	TOTAL(MBTU)	22.764	222.157
DEC	PEAK(KBTU)	88.871	1581.841
	DY/HR	30/14	8/13
	ONE YEAR	184.545	1010.134
	USE/PEAK	88.871	1581.841

ENERGY TYPE IN SITE MBTU - CATEGORY OF USE	ELECTRICITY	NATURAL-GAS
SPACE HEAT	40.84	1010.13
SPACE COOL	0.00	0.00
HVAC AUX	27.22	0.00
DOM HOT WTR	0.00	0.00
AUX SOLAR	0.00	0.00
LIGHTS	116.48	0.00
VERT TRANS	0.00	0.00
MISC EQUIP	0.00	0.00
TOTAL	184.55	1010.13

TOTAL SITE ENERGY 1194.68 MBTU 114.1 KBTU/SQFT-YR GROSS-AREA 138.3 KBTU/SQFT-YR NET-AREA
TOTAL SOURCE ENERGY 1564.32 MBTU 149.3 KBTU/SQFT-YR GROSS-AREA 181.1 KBTU/SQFT-YR NET-AREA
PERCENT OF HOURS ANY SYSTEM ZONE OUTSIDE OF THROTTLING RANGE = 8.3
PERCENT OF HOURS ANY PLANT LOAD NOT SATISFIED = 0.0
NOTE ELECTRICITY AND/OR FUEL USED TO GENERATE ELECTRICITY IS APPORTIONED BASED ON THE YEARLY DEMAND. ALL OTHER ENERGY TYPES ARE APPORTIONED HOURLY.

EMC ENGINEERS INC. EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/ 9/1995 16:16:54 SDL RUN 1
DENVER, CO 80227 PROPOSED UP-GRADE FOR BLDG. #~~7176~~ 741 VEHICAL MAINT BAY
REPORT- SS-A SYSTEM MONTHLY LOADS SUMMARY FOR GAS_IR TOPEKA, KS

MONTH	COOLING: COOLING ENERGY (MBTU)	COOLING: TIME OF MAX DY	COOLING: TIME OF MAX HR	COOLING: DRY-BULB TEMP	COOLING: WET-BULB TEMP	COOLING: MAXIMUM COOLING LOAD (KBTU/HR)	HEATING: HEATING ENERGY (MBTU)	HEATING: TIME OF MAX DY	HEATING: TIME OF MAX HR	HEATING: DRY-BULB TEMP	HEATING: WET-BULB TEMP	HEATING: MAXIMUM HEATING LOAD (KBTU/HR)	ELEC: ELEC-TRICAL ENERGY (KWH)	ELEC: MAXIMUM ELEC LOAD (KW)
JAN	0.00000					0.000	-161.324	14	9	-3.F	-4.F	-1209.730	2843.	14.250
FEB	0.00000					0.000	-114.568	14	10	30.F	27.F	-775.229	2572.	14.250
MAR	0.00000					0.000	-95.488	3	8	15.F	12.F	-989.212	3114.	14.250
APR	0.00000					0.000	-29.269	4	10	34.F	31.F	-672.389	2843.	14.250
MAY	0.00000					0.000	-3.843	5	8	46.F	41.F	-233.841	2843.	14.250
JUN	0.00000					0.000	0.000					0.000	2978.	14.250
JUL	0.00000					0.000	0.000					0.000	2708.	14.250
AUG	0.00000					0.000	0.000					0.000	3114.	14.250
SEP	0.00000					0.000	0.000					0.000	2843.	14.250
OCT	0.00000					0.000	-21.190	19	10	38.F	34.F	-582.407	2708.	14.250
NOV	0.00000					0.000	-64.499	30	8	28.F	25.F	-638.875	2708.	14.250
DEC	0.00000					0.000	-146.027	8	13	20.F	17.F	-1193.378	2843.	14.250
TOTAL	0.000						-636.209						34115.	
MAX						0.000						-1209.730		14.250

EMC ENGINEERS INC. EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/ 9/1995 16:16:54 SDL RUN 1
DENVER, CO 80227 PROPOSED UP-GRADE FOR BLDG. #7176 VEHICAL MAINT BAY
REPORT- SS-C SYSTEM MONTHLY LOAD HOURS FOR GAS_IR TOPEKA, KS

MONTH	HOURS COOLING LOAD	HOURS HEATING LOAD	HOURS COINCIDENT COOL-HEAT LOAD	HOURS FLOATING	HOURS HEATING AVAIL.	HOURS COOLING AVAIL.	HOURS FANS ON	HOURS FANS CYCLE ON	HOURS NIGHT VENTING	HOURS FLOATING WHEN FANS ON	COINCIDENT LOADS: HEATING LOAD AT COOLING PEAK (KBTU/HR)	COINCIDENT LOADS: ELECTRIC LOAD AT COOLING PEAK (KW)
JAN	0	744	0	0	744	744	744	0	0	0	-97.173	0.000
FEB	0	671	0	1	672	672	672	0	0	1	-96.123	0.000
MAR	0	710	0	34	744	744	744	0	0	34	-96.846	0.000
APR	0	325	0	395	720	720	720	0	0	395	0.000	0.000
MAY	0	76	0	668	360	744	360	0	0	284	0.000	0.000
JUN	0	0	0	720	0	720	0	0	0	0	0.000	0.000
JUL	0	0	0	744	0	744	0	0	0	0	0.000	0.000
AUG	0	0	0	744	0	744	0	0	0	0	0.000	0.000
SEP	0	0	0	720	0	720	0	0	0	0	0.000	0.000
OCT	0	290	0	454	720	744	720	0	0	430	-68.154	0.000
NOV	0	580	0	140	720	720	720	0	0	140	-107.993	0.000
DEC	0	743	0	1	744	744	744	0	0	1	-107.135	0.000
ANNUAL	0	4139	0	4621	5424	8760	5424	0	0	1285		

EMC ENGINEERS INC. EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/ 9/1995 16:16:54 PDL RUN 1
DENVER, CO 80227 PROPOSED UP-GRADE FOR BLDG. #~~7176~~741 VEHICAL MAINT BAY
TOPEKA, KS
REPORT- PS-B MONTHLY PEAK AND TOTAL ENERGY USE

MO	UTILITY-	ELECTRICITY	NATURAL-GAS
	TOTAL(MBTU)	13.417	207.320
JAN	PEAK(KBTU)	76.480	1342.800
	DY/HR	14/ 9	14/ 9
	TOTAL(MBTU)	11.417	152.426
FEB	PEAK(KBTU)	66.486	904.349
	DY/HR	14/10	14/10
	TOTAL(MBTU)	12.827	130.745
MAR	PEAK(KBTU)	71.408	1125.162
	DY/HR	3/ 8	3/ 8
	TOTAL(MBTU)	10.380	42.944
APR	PEAK(KBTU)	64.121	794.853
	DY/HR	4/10	4/10
	TOTAL(MBTU)	9.795	6.521
MAY	PEAK(KBTU)	54.034	303.345
	DY/HR	5/ 8	5/ 8
	TOTAL(MBTU)	10.169	0.000
JUN	PEAK(KBTU)	48.656	0.000
	DY/HR	30/16	30/ 1
	TOTAL(MBTU)	9.245	0.000
JUL	PEAK(KBTU)	48.656	0.000
	DY/HR	29/16	31/ 1
	TOTAL(MBTU)	10.631	0.000
AUG	PEAK(KBTU)	48.656	0.000
	DY/HR	31/16	31/ 1
	TOTAL(MBTU)	9.707	0.000
SEP	PEAK(KBTU)	48.656	0.000
	DY/HR	30/16	30/ 1
	TOTAL(MBTU)	9.732	32.516
OCT	PEAK(KBTU)	62.051	697.252
	DY/HR	19/10	19/10
	TOTAL(MBTU)	10.728	91.211
NOV	PEAK(KBTU)	63.350	758.697
	DY/HR	30/ 8	30/ 8
	TOTAL(MBTU)	13.065	189.783
DEC	PEAK(KBTU)	76.103	1327.008
	DY/HR	8/13	8/13
	ONE YEAR	131.115	853.466
	USE/PEAK	76.480	1342.800

EMC ENGINEERS INC. EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/ 9/1995 16:16:54 PDL RUN 1
DENVER, CO 80227 PROPOSED UP-GRADE FOR BLDG. ~~#7170~~ 741 VEHICAL MAINT BAY
REPORT- BEPS ESTIMATED BUILDING ENERGY PERFORMANCE TOPEKA, KS

ENERGY TYPE IN SITE MBTU - CATEGORY OF USE	ELECTRICITY	NATURAL-GAS
SPACE HEAT	0.00	853.47
SPACE COOL	0.00	0.00
HVAC AUX	14.63	0.00
DOM HOT WTR	0.00	0.00
AUX SOLAR	0.00	0.00
LIGHTS	116.48	0.00
VERT TRANS	0.00	0.00
MISC EQUIP	0.00	0.00
TOTAL	131.11	853.47

TOTAL SITE ENERGY 984.58 MBTU 94.0 KBTU/SQFT-YR GROSS-AREA 114.0 KBTU/SQFT-YR NET-AREA
TOTAL SOURCE ENERGY 1247.20 MBTU 119.1 KBTU/SQFT-YR GROSS-AREA 144.4 KBTU/SQFT-YR NET-AREA
PERCENT OF HOURS ANY SYSTEM ZONE OUTSIDE OF THROTTLING RANGE = 0.0
PERCENT OF HOURS ANY PLANT LOAD NOT SATISFIED = 0.0
NOTE ELECTRICITY AND/OR FUEL USED TO GENERATE ELECTRICITY IS APPORTIONED BASED ON THE YEARLY DEMAND. ALL OTHER ENERGY TYPES ARE APPORTIONED HOURLY.

BUILDING 820
ANNUAL ENERGY SAVINGS SUMMARY

Item	Baseline	ECO	Annual Energy Savings	Adj. Annual Energy Savings*
Annual Electric (MBTU)	141.02	129.27	11.75	10.96
Annual Natural Gas (MBTU)	490.89	379.78	111.11	103.65
Electric Demand June (KW)	14.26	14.26	0.00	0.00
Electric Demand July (KW)	14.26	14.26	0.00	0.00
Electric Demand August (KW)	14.26	14.26	0.00	0.00

*Energy savings prorated on a square foot basis:

Baseline Model Bldg 8300 (sq.ft.)	8640
ECO Model Bldg 820 (sq.ft.)	8060
Square Footage Adjustment Factor	0.933

LIFE CYCLE COST ANALYSIS SUMMARY
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

LOCATION:	Fort Riley	REGION: 2 (Kansas)		PROJECT NO:	1406-005
PROJECT TITLE:	Feasibility Study for HVAC Upgrade			FISCAL YEAR:	1995
ANALYSIS DATE:	03/07/95	ECONOMIC LIFE:	20	PREPARED BY:	C. Wohlert

1. INVESTMENT: **BLDG 820 - Replace HW UHs w/ Gas-fired Infrared Tube Heating System**

A.	CONSTRUCTION COST	=	$42,553	
B.	SIOH COST	(5.5% of 1A) =	$2,340	
C.	DESIGN COST	(6.0% of 1A) =	$2,553	
D.	TOTAL COST	(1A +1B +1C) =	$47,446	
E.	SALVAGE VALUE OF EXISTING EQUIPMENT =		$9,900	
F.	PUBLIC UTILITY COMPANY REBATE =		$0	
G.	TOTAL INVESTMENT	(1D -1E -1F) =	------->	$37,546

2. ENERGY SAVINGS (+) OR COST (-):

DATE OF NISTR 85-3273-9 USED FOR DISCOUNT FACTORS: JAN '95

	ENERGY SOURCE	FUEL COST $/MBTU (1)	SAVINGS MBTU/YR (2)	ANNUAL $ SAVINGS (3)	DISCOUNT FACTOR (4)	DISCOUNTED SAVINGS (5)	
A.	ELECT.	$12.10	11	$133	15.88	$2,106	
B.	DIST	$0.00	0	$0	19.16	$0	
C.	NAT GAS	$4.12	104	$427	18.30	$7,815	
D.	COAL	$0.00	0	$0	16.62	$0	
E.	DEMAND (KW)	$4.20	0	$0	14.88	$0	
F.	TOTAL		115	$560		-------->	$9,921

3. NON-ENERGY SAVINGS (+) OR COST (-)

A. ANNUAL RECURRING (+/-)

1 ANNUAL MAINTENANCE	$370	14.88	$5,508
2	$0	14.88	$0
3	$0	14.88	$0
4 TOTAL ANNUAL DISC. SAVINGS (+) / COST	$370		$5,508

B. NON-RECURRING (+/-)

ITEM	SAVINGS (+) COST(-) (1)	YEAR OF OCCURRENCE (2)	DISCOUNT FACTOR (3) (TABLE A-2)	DISCOUNTED SAVINGS/COST (4)
a. BASELINE EQUIP. REPLACEMEN	$43,700	5	0.863	$37,713
b.				$0
c.				$0
d.				$0
e.				$0
f. TOTAL	$43,700			$37,713

C. TOTAL NON-ENERGY DISCOUNTED SAVINGS (+) OR COST (-) (3A4 + 3Bf4) = $43,221

4.	FIRST YEAR DOLLAR SAVINGS (+) / COSTS (-)	(2F3+3A4+(3Bf1/Economic Life))	$3,115
5.	SIMPLE PAYBACK (SPB) IN YEARS (MUST BE < 10 YEARS TO QUALIFY)	(1G/4) =	12.05
6.	TOTAL NET DISCOUNTED SAVINGS	(2F5 + 3C) =	$53,141
7.	DISCOUNTED SAVINGS-TO-INVESTMENT RATIO (SIR) (MUST HAVE SIR > 1.25 TO QUALIFY)	(6/1G) =	1.42

ENGINEER'S OPINION OF PROBABLE COST

PROJECT	Fort Riley Feasibility Study for HVAC Upgrade	**SHEET**	1 **OF** 1
ENGINEER	E M C Engineers, Inc.	**DATE PREPARED**	1-Mar-95
	Denver, CO	**ESTIMATOR**	C. Wohlert
		CHECKED BY	A. Niemeyer

Line No.	Item Refer Code	Item Description	Unit of Measure	MATERIAL COST Quantity	MATERIAL COST Unit Cost	MATERIAL COST Total	LABOR COST Crew/ Worker	LABOR COST Hours/ Unit	LABOR COST Total	TOTAL
1		**BUILDING 820**								
2		**PROPOSED SYSTEM MODIFICATIONS**								
3										
4		*NEW SYSTEMS INSTALLATION*								
5	STLPIP2	STEEL PIPE SCH. 40, 2" W/HANGERS	L.F.	150.0	$3.91	$587	Q-1	0.25	$727	$1,314
6	INSLPIP2	2" FIBERGLASS PIPE INSULATION, 1.5" THCK	L.F.	150.0	$1.46	$219	Q-14	0.084	$232	$452
7	STLPIP1.5	STEEL PIPE SCH. 40, 1.5" W/HANGERS	L.F.	40.0	$2.95	$118	Q-1	0.2	$155	$273
8	STLPIP1.2	STEEL PIPE SCH. 40, 1.25" W/HANGERS	L.F.	70.0	$2.56	$179	Q-1	0.2	$271	$451
9	STLPIP0.7	STEEL PIPE SCH. 40, 0.75" W/HANGERS	L.F.	4.0	$1.51	$6	1-PLUM	0.2	$17	$23
10	STLPIP0.5	STEEL PIPE SCH. 40, 0.5" W/HANGERS	L.F.	80.0	$1.33	$106	1-PLUM	0.2	$345	$451
11	HWBLR2	1,613 MBH HOT WATER BOILER	EA.	1.0	$9,786.90	$9,787	Q-7	76.19	$1,566	$11,353
12	IRHEAT	GAS FIRED IR TUBE SYSTEMS / BURNER	EA.	6.0	$1,564.94	$9,390	Q-6	18.24	$2,200	$11,590
13	ELCND1	ELECTRICAL CONDUIT 1"	L.F.	200.0	$0.83	$167	1-ELEC	0.064	$268	$435
14	WIRE#6	COPPER WIRING #6	C.L.F.	3.0	$24.71	$74	1-ELEC	1.231	$77	$151
15	GASCN	FLEXIBLE CONNECTOR 12" LONG	EA.	6.0	$7.90	$47	1-PLUM	0.222	$29	$76
16										
17		*EXISTING SYSTEMS DEMOLITION*								
18		BOILER DEMOLITION (Salv Value = $7,000)	EA.	1.5			Q-6	12	$362	$362
19		UNIT HEATER DEMOLITION (Salv Value = $2,900)	TON	1.0			Q-5	14.545	$282	$282
20		HW PIPING DEMOLITION	L.F.	450.0			1-PLUM	0.04	$388	$388
21										
22										
23										
24										
25										
26										
27										
28										
29										
30										
31		**SUBTOTAL**				$20,681			$6,919	$27,600
32	OH	OVERHEAD			17%	$3,474			$1,162	$4,637
33	PRO	PROFIT			10%	$2,415			$808	$3,224
34	CONT	CONTINGENCY			20%	$5,314			$1,778	$7,092
35	**TOTAL COST**		-	-	-	$31,884	-	-	$10,668	$42,553

ENGINEER'S OPINION OF PROBABLE COST

PROJECT	Fort Riley Feasibility Study for HVAC Upgrade	**SHEET** 1 **OF** 1	
		DATE PREPARED	15-Mar-95
ENGINEER	E M C Engineers, Inc. Denver, CO	**ESTIMATOR**	C. Wohlert
		CHECKED BY	A. Niemeyer

Line No.	Item Refer Code	Item Description	Unit of Measure	MATERIAL COST Quantity	MATERIAL COST Unit Cost	MATERIAL COST Total	LABOR COST Crew/ Worker	LABOR COST Hours/ Unit	LABOR COST Total	TOTAL
1		**BUILDING 820**								
2		**NON-RECURRING**								
3										
4		*BASELINE - EXISTING EQUIP. REPLACEMENT*								
5	HWBLR3	2,312 MBH HOT WATER BOILER	EA.	1.0	$14,051	$14,051	Q-7	88.889	$1,827	$15,878
6	STLPIP2	STEEL PIPE SCH. 40, 2" W/HANGERS	L.F.	450.0	$3.91	$1,762	Q-1	0.25	$2,181	$3,943
7	INSLPIP2	2" FIBERGLASS PIPE INSULATION, 1.5" THCK	L.F.	450.0	$1.46	$658	Q-14	0.084	$696	$1,355
8	UH7	HORIZ. UNIT HEATER, PROPELLER, 87.6 MBH	EA.	8.0	$731.60	$5,853	Q-5	2.462	$382	$6,235
9										
10										
11										
12										
13		*EXISTING SYSTEMS DEMOLITION*								
14		BOILER DEMOLITION	EA.	1.5			Q-6	12	$362	$362
15		UNIT HEATER DEMOLITION	TON	1.0			Q-5	14.545	$282	$282
16		HW PIPING DEMOLITION	L.F.	450.0			PLUM	0.04	$290	$290
17										
18										
19										
20										
21										
22										
23										
24										
25										
26										
27										
28										
29										
30										
31		**SUBTOTAL**				$22,323			$6,021	$28,344
32	OH	OVERHEAD			17%	$3,750			$1,012	$4,762
33	PRO	PROFIT			10%	$2,607			$703	$3,311
34	CONT	CONTINGENCY			20%	$5,736			$1,547	$7,283
35	**TOTAL COST**		-	-	-	$34,417	-	-	$9,283	$43,700

ENGINEER'S OPINION OF PROBABLE COST

PROJECT	Fort Riley Feasibility Study for HVAC Upgrade	SHEET 1 OF 1	
ENGINEER	E M C Engineers, Inc. Denver, CO	DATE PREPARED	1-Mar-95
		ESTIMATOR	C. Wohlert
		CHECKED BY	A. Niemeyer

Line No.	Item Refer Code	Item Description	Unit of Measure	MATERIAL COST Quantity	MATERIAL COST Unit Cost	MATERIAL COST Total	LABOR COST Crew/ Worker	LABOR COST Hours/ Unit	LABOR COST Total	TOTAL
1		**BUILDING 820**								
2		***ANNUAL RECURRING***								
3		***ANNUAL MAINTENANCE COST - BASELINE***								
4	MNT-BLR	MAINT. ON BOILERS - >2.5 MBH	EA.	1.0	$96.90	$97	Q-6	25	$503	$600
5	MNT-UH	MAINT. ON UHS - INSPEC. / YR	EA.	8.0			Q-6	4	$643	$643
6										
7										
8										
9										
10										
11										
12										
13										
14										
15	**TOTAL ANNUAL MAINTENANCE COST - BASELINE**		-	-	-	$97	-	-	$1,146	$1,243
16										
17		***ANNUAL MAINTENANCE COST - NEW HVAC REPLACEMENT***								
18	MNT-BLR	MAINT. ON BOILERS - <2.5 MBH	EA.	1.0	$48.45	$48	Q-6	17	$342	$390
19	MNT-IR	MAINT. ON IR HEATERS - INSPEC. / YR	EA.	6.0			Q-6	4	$483	$483
20										
21										
22										
23										
24										
25										
26										
27										
28										
29	**TOTAL ANNUAL MAINTENANCE COST - BASELINE**		-	-	-	$48	-	-	$824	$873
30										
31										
32										
33										
34										
35	**TOTAL ANNUAL MAINTENANCE COST SAVINGS**		-	-	-	$48	-	-	$322	$370

NUMBER OF EXTERIOR SURFACES 4 RECTANGULAR 4 OTHER 0
(U-VALUE INCLUDES INSIDE AIR FILM PLUS OUTSIDE AIR FILM AT 7.5 MPH WINDSPEED)

SURFACE	SPACE	- - - - G L A S S - - - - U-VALUE (BTU/HR-SQFT-F)	AREA (SQFT)	- - - - W A L L - - - - U-VALUE (BTU/HR-SQFT-F)	AREA (SQFT)	- W A L L + G L A S S - U-VALUE (BTU/HR-SQFT-F)	AREA (SQFT)	AZIMUTH
	BAY-AREA	0.000	0.00	0.133	3600.00	0.133	3600.00	NORTH-EAST
	BAY-AREA	0.490	56.00	0.133	3544.00	0.139	3600.00	SOUTH-WEST
	BAY-AREA	0.490	266.00	0.133	1234.00	0.196	1500.00	NORTH-WEST
	BAY-AREA	0.000	0.00	0.092	7440.00	0.092	7440.00	ROOF
	BAY-AREA	0.000	0.00	0.020	7440.00	0.020	7440.00	UNDERGRND

EMC ENGINEERS INC. EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/ 7/1995 13: 8:50 LDL RUN 1
DENVER, CO 80227 EXISTING CONDITION FOR BLDG. #820 VEHICAL MAINT BAY
REPORT- LV-D DETAILS OF EXTERIOR SURFACES IN THE PROJECT TOPEKA, KS

	AVERAGE U-VALUE/GLASS (BTU/HR-SQFT-F)	AVERAGE U-VALUE/WALLS (BTU/HR-SQFT-F)	AVERAGE U-VALUE WALLS+GLASS (BTU/HR-SQFT-F)	GLASS AREA (SQFT)	OPAQUE AREA (SQFT)	GLASS+OPAQUE AREA (SQFT)
NORTH-EAST	0.000	0.133	0.133	0.00	3600.00	3600.00
SOUTH-WEST	0.490	0.133	0.139	56.00	3544.00	3600.00
NORTH-WEST	0.490	0.133	0.196	266.00	1234.00	1500.00
ROOF	0.000	0.092	0.092	0.00	7440.00	7440.00
ALL WALLS	0.490	0.133	0.146	322.00	8378.00	8700.00
WALLS+ROOFS	0.490	0.114	0.121	322.00	15818.00	16140.00
UNDERGRND	0.000	0.020	0.020	0.00	7440.00	7440.00
BUILDING	0.490	0.084	0.089	322.00	23258.00	23580.00

REPORT- LS-C BUILDING PEAK LOAD COMPONENTS

*** BUILDING ***

FLOOR AREA	8640	SQFT	803	SQMT
VOLUME	216000	CUFT	6117	CUMT

	COOLING LOAD				HEATING LOAD		
TIME	AUG 4 4PM				JAN 4 3AM		
DRY-BULB TEMP	93F	34C			8F	-13C	
WET-BULB TEMP	70F	21C			7F	-14C	
	SENSIBLE		LATENT		SENSIBLE		
	(KBTU/H)	(KW)	(KBTU/H)	(KW)	(KBTU/H)	(KW)	
WALLS	32.204	9.432	0.000	0.000	-44.491	-13.030	
ROOFS	57.900	16.957	0.000	0.000	-41.168	-12.057	
GLASS CONDUCTION	2.350	0.688	0.000	0.000	-10.154	-2.974	
GLASS SOLAR	9.120	2.671	0.000	0.000	0.610	0.179	
DOOR	29.695	8.697	0.000	0.000	-39.883	-11.681	
INTERNAL SURFACES	0.000	0.000	0.000	0.000	0.000	0.000	
UNDERGROUND SURFACES	-0.109	-0.032	0.000	0.000	-3.677	-1.077	
OCCUPANTS TO SPACE	9.121	2.671	17.500	5.125	0.808	0.237	
LIGHT TO SPACE	38.796	11.362	0.000	0.000	5.778	1.692	
EQUIPMENT TO SPACE	0.000	0.000	0.000	0.000	0.000	0.000	
PROCESS TO SPACE	0.000	0.000	0.000	0.000	0.000	0.000	
INFILTRATION	0.000	0.000	0.000	0.000	-126.082	-36.926	
TOTAL	179.077	52.447	17.500	5.125	-258.259	-75.638	
TOTAL LOAD	196.577 KBTU/H		57.572	KW	-258.259 KBTU/H	-75.638	KW
TOTAL LOAD / AREA	22.75BTU/H.SQFT		71.725	W /SQMT	29.891BTU/H.SQFT	94.231	W /SQMT

****
NOTE 1)THE ABOVE LOADS EXCLUDE OUTSIDE VENTILATION AIR LOADS
---- 2)TIMES GIVEN IN STANDARD TIME FOR THE LOCATION IN CONSIDERATION
****

EMC ENGINEERS INC. EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/ 7/1995 13: 8:50 SDL RUN 1
DENVER, CO 80227 EXISTING CONDITION FOR BLDG. #820 VEHICAL MAINT BAY
REPORT- SS-A SYSTEM MONTHLY LOADS SUMMARY FOR UNIT-HEATS TOPEKA, KS

	COOLING						HEATING						ELEC	
MONTH	COOLING ENERGY (MBTU)	TIME OF MAX DY	HR	DRY-BULB TEMP	WET-BULB TEMP	MAXIMUM COOLING LOAD (KBTU/HR)	HEATING ENERGY (MBTU)	TIME OF MAX DY	HR	DRY-BULB TEMP	WET-BULB TEMP	MAXIMUM HEATING LOAD (KBTU/HR)	ELEC-TRICAL ENERGY (KWH)	MAXIMUM ELEC LOAD (KW)
JAN	0.00000					0.000	-79.641	16	6	10.F	8.F	-373.671	2941.	14.688
FEB	0.00000					0.000	-59.710	3	6	-1.F	-2.F	-308.732	2643.	14.592
MAR	0.00000					0.000	-47.152	3	4	16.F	13.F	-300.383	3169.	14.599
APR	0.00000					0.000	-14.941	4	6	32.F	31.F	-186.246	2860.	14.436
MAY	0.00000					0.000	-1.975	5	5	44.F	40.F	-96.658	2845.	14.289
JUN	0.00000					0.000	0.000					0.000	2978.	14.250
JUL	0.00000					0.000	0.000					0.000	2708.	14.250
AUG	0.00000					0.000	0.000					0.000	3114.	14.250
SEP	0.00000					0.000	0.000					0.000	2843.	14.250
OCT	0.00000					0.000	-11.400	31	6	44.F	39.F	-161.136	2720.	14.396
NOV	0.00000					0.000	-36.401	2	6	15.F	14.F	-230.468	2750.	14.474
DEC	0.00000					0.000	-71.124	15	5	8.F	7.F	-339.624	2929.	14.648
TOTAL	0.000						-322.343						34499.	
MAX						0.000						-373.671		14.688

EMC ENGINEERS INC. EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/ 7/1995 13: 8:50 SDL RUN 1
DENVER, CO 80227 EXISTING CONDITION FOR BLDG. #820 VEHICAL MAINT BAY
REPORT- SS-C SYSTEM MONTHLY LOAD HOURS FOR UNIT-HEATS TOPEKA, KS

	NUMBER OF HOURS										COINCIDENT LOADS	
MONTH	HOURS COOLING LOAD	HOURS HEATING LOAD	HOURS COINCIDENT COOL-HEAT LOAD	HOURS FLOATING	HOURS HEATING AVAIL.	HOURS COOLING AVAIL.	HOURS FANS ON	HOURS FANS CYCLE ON	HOURS NIGHT VENTING	HOURS FLOATING WHEN FANS ON	HEATING LOAD AT COOLING PEAK (KBTU/HR)	ELECTRIC LOAD AT COOLING PEAK (KW)
JAN	0	372	0	372	744	0	372	372	0	0	-181.318	0.214
FEB	0	336	0	336	672	0	336	336	0	0	-177.371	0.210
MAR	0	350	0	394	744	0	351	351	0	1	0.000	0.000
APR	0	181	0	539	720	0	279	279	0	98	0.000	0.000
MAY	0	38	0	706	360	0	179	179	0	141	0.000	0.000
JUN	0	0	0	720	0	0	0	0	0	0	0.000	0.000
JUL	0	0	0	744	0	0	0	0	0	0	0.000	0.000
AUG	0	0	0	744	0	0	0	0	0	0	0.000	0.000
SEP	0	0	0	720	0	0	0	0	0	0	0.000	0.000
OCT	0	166	0	578	720	0	259	259	0	93	-126.969	0.145
NOV	0	307	0	413	720	0	313	313	0	6	0.000	0.000
DEC	0	372	0	372	744	0	372	372	0	0	0.000	0.000
ANNUAL	0	2122	0	6638	5424	0	2461	2461	0	339		

EMC ENGINEERS INC. EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/ 7/1995 13: 8:50 PDL RUN 1
DENVER, CO 80227 EXISTING CONDITION FOR BLDG. #820 VEHICAL MAINT BAY
REPORT- PS-B MONTHLY PEAK AND TOTAL ENERGY USE TOPEKA, KS

MO	UTILITY-	ELECTRICITY	NATURAL-GAS
	TOTAL(MBTU)	14.370	115.695
JAN	PEAK(KBTU)	61.851	497.806
	DY/HR	14/10	16/ 6
	TOTAL(MBTU)	12.928	89.889
FEB	PEAK(KBTU)	61.521	424.235
	DY/HR	3/ 8	3/ 6
	TOTAL(MBTU)	14.653	73.667
MAR	PEAK(KBTU)	61.545	414.604
	DY/HR	3/ 8	3/ 4
	TOTAL(MBTU)	11.517	25.084
APR	PEAK(KBTU)	60.991	278.996
	DY/HR	4/ 8	4/ 6
	TOTAL(MBTU)	10.021	3.472
MAY	PEAK(KBTU)	55.416	167.408
	DY/HR	5/ 9	5/ 5
	TOTAL(MBTU)	10.169	0.000
JUN	PEAK(KBTU)	48.656	0.000
	DY/HR	30/16	30/ 1
	TOTAL(MBTU)	9.245	0.000
JUL	PEAK(KBTU)	48.656	0.000
	DY/HR	29/16	31/ 1
	TOTAL(MBTU)	10.631	0.000
AUG	PEAK(KBTU)	48.656	0.000
	DY/HR	31/16	31/ 1
	TOTAL(MBTU)	9.707	0.000
SEP	PEAK(KBTU)	48.656	0.000
	DY/HR	30/16	30/ 1
	TOTAL(MBTU)	10.774	19.450
OCT	PEAK(KBTU)	60.852	248.176
	DY/HR	31/ 8	31/ 6
	TOTAL(MBTU)	12.689	58.187
NOV	PEAK(KBTU)	61.119	332.409
	DY/HR	3/ 8	2/ 6
	TOTAL(MBTU)	14.315	105.442
DEC	PEAK(KBTU)	61.715	459.530
	DY/HR	14/ 9	15/ 5
	ONE YEAR	141.019	490.886
	USE/PEAK	61.851	497.806

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EMC         ENGINEERS    INC.      EZDOE - ELITE SOFTWARE DEVELOPMENT INC      DOE-2.1D   2/ 7/1995    13: 8:50  PDL RUN 1
  DENVER,       CO       80227     EXISTING CONDITION FOR BLDG. #820       VEHICAL MAINT BAY
REPORT- BEPS ESTIMATED BUILDING ENERGY PERFORMANCE                                 TOPEKA, KS
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ENERGY TYPE IN SITE MBTU - CATEGORY OF USE	ELECTRICITY	NATURAL-GAS
SPACE HEAT	15.87	490.89
SPACE COOL	0.00	0.00
HVAC AUX	8.66	0.00
DOM HOT WTR	0.00	0.00
AUX SOLAR	0.00	0.00
LIGHTS	116.48	0.00
VERT TRANS	0.00	0.00
MISC EQUIP	0.00	0.00
TOTAL	141.02	490.89

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TOTAL SITE ENERGY       631.91 MBTU      60.3 KBTU/SQFT-YR GROSS-AREA      73.1 KBTU/SQFT-YR NET-AREA
TOTAL SOURCE ENERGY     914.37 MBTU      87.3 KBTU/SQFT-YR GROSS-AREA     105.8 KBTU/SQFT-YR NET-AREA
PERCENT OF HOURS ANY SYSTEM ZONE OUTSIDE OF THROTTLING RANGE =  9.5
PERCENT OF HOURS ANY PLANT LOAD NOT SATISFIED                =  0.0
NOTE  ELECTRICITY AND/OR FUEL USED TO GENERATE ELECTRICITY IS APPORTIONED BASED
      ON THE YEARLY DEMAND.  ALL OTHER ENERGY TYPES ARE APPORTIONED HOURLY.
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EMC ENGINEERS INC. EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/ 7/1995 9: 8:17 SDL RUN 1
DENVER, CO 80227 PROPOSED SYSTEMS FOR BLDG. #820 VEHICAL MAINT BAY
REPORT- SS-A SYSTEM MONTHLY LOADS SUMMARY FOR SIM-IR-HET TOPEKA, KS

	COOLING						HEATING						ELEC	
MONTH	COOLING ENERGY (MBTU)	TIME OF MAX DY	HR	DRY-BULB TEMP	WET-BULB TEMP	MAXIMUM COOLING LOAD (KBTU/HR)	HEATING ENERGY (MBTU)	TIME OF MAX DY	HR	DRY-BULB TEMP	WET-BULB TEMP	MAXIMUM HEATING LOAD (KBTU/HR)	ELEC-TRICAL ENERGY (KWH)	MAXIMUM ELEC LOAD (KW)
JAN	0.00000					0.000	-81.477	4	3	8.F	7.F	-236.845	2843.	14.250
FEB	0.00000					0.000	-59.727	1	23	17.F	15.F	-193.550	2572.	14.250
MAR	0.00000					0.000	-44.909	3	4	16.F	13.F	-187.838	3114.	14.250
APR	0.00000					0.000	-11.118	4	6	32.F	31.F	-113.222	2843.	14.250
MAY	0.00000					0.000	-0.690	9	6	44.F	44.F	-48.750	2843.	14.250
JUN	0.00000					0.000	0.000					0.000	2978.	14.250
JUL	0.00000					0.000	0.000					0.000	2708.	14.250
AUG	0.00000					0.000	0.000					0.000	3114.	14.250
SEP	0.00000					0.000	0.000					0.000	2843.	14.250
OCT	0.00000					0.000	-7.466	20	6	24.F	23.F	-97.690	2708.	14.250
NOV	0.00000					0.000	-34.121	2	6	15.F	14.F	-141.010	2708.	14.250
DEC	0.00000					0.000	-72.463	11	24	10.F	9.F	-204.299	2843.	14.250
TOTAL	0.000						-311.972						34115.	
MAX						0.000						-236.845		14.250

EMC ENGINEERS INC. EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/ 7/1995 9: 8:17 SDL RUN 1
DENVER, CO 80227 PROPOSED SYSTEMS FOR BLDG. #820 VEHICAL MAINT BAY
REPORT- SS-C SYSTEM MONTHLY LOAD HOURS FOR SIM-IR-HET TOPEKA, KS

	NUMBER OF HOURS										COINCIDENT LOADS	
MONTH	HOURS COOLING LOAD	HOURS HEATING LOAD	HOURS COINCIDENT COOL-HEAT LOAD	HOURS FLOATING	HOURS HEATING AVAIL.	HOURS COOLING AVAIL.	HOURS FANS ON	HOURS FANS CYCLE ON	HOURS NIGHT VENTING	HOURS FLOATING WHEN FANS ON	HEATING LOAD AT COOLING PEAK (KBTU/HR)	ELECTRIC LOAD AT COOLING PEAK (KW)
JAN	0	735	0	9	744	744	744	0	0	9	-96.879	0.000
FEB	0	660	0	12	672	672	672	0	0	12	-95.210	0.000
MAR	0	626	0	118	744	744	744	0	0	118	-96.201	0.000
APR	0	263	0	457	720	720	720	0	0	457	0.000	0.000
MAY	0	35	0	709	360	744	360	0	0	325	0.000	0.000
JUN	0	0	0	720	0	720	0	0	0	0	0.000	0.000
JUL	0	0	0	744	0	744	0	0	0	0	0.000	0.000
AUG	0	0	0	744	0	744	0	0	0	0	0.000	0.000
SEP	0	0	0	720	0	720	0	0	0	0	0.000	0.000
OCT	0	222	0	522	720	744	720	0	0	498	-67.525	0.000
NOV	0	538	0	182	720	720	720	0	0	182	-107.207	0.000
DEC	0	725	0	19	744	744	744	0	0	19	-107.586	0.000
ANNUAL	0	3804	0	4956	5424	8760	5424	0	0	1620		

EMC ENGINEERS INC. EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/ 7/1995 9: 8:17 PDL RUN 1
DENVER, CO 80227 PROPOSED SYSTEMS FOR BLDG. #820 VEHICAL MAINT BAY
REPORT- PS-B MONTHLY PEAK AND TOTAL ENERGY USE TOPEKA, KS

MO	UTILITY-	ELECTRICITY	NATURAL-GAS
	TOTAL(MBTU)	13.047	96.850
JAN	PEAK(KBTU)	57.383	262.898
	DY/HR	14/ 9	4/ 3
	TOTAL(MBTU)	11.231	72.473
FEB	PEAK(KBTU)	54.805	220.166
	DY/HR	3/ 8	1/23
	TOTAL(MBTU)	12.473	55.366
MAR	PEAK(KBTU)	55.304	214.380
	DY/HR	3/ 8	3/ 4
	TOTAL(MBTU)	10.163	14.432
APR	PEAK(KBTU)	52.117	135.631
	DY/HR	4/ 8	4/ 6
	TOTAL(MBTU)	9.735	0.999
MAY	PEAK(KBTU)	48.656	62.846
	DY/HR	31/16	9/ 6
	TOTAL(MBTU)	10.169	0.000
JUN	PEAK(KBTU)	48.656	0.000
	DY/HR	30/16	30/ 1
	TOTAL(MBTU)	9.245	0.000
JUL	PEAK(KBTU)	48.656	0.000
	DY/HR	29/16	31/ 1
	TOTAL(MBTU)	10.631	0.000
AUG	PEAK(KBTU)	48.656	0.000
	DY/HR	31/16	31/ 1
	TOTAL(MBTU)	9.707	0.000
SEP	PEAK(KBTU)	48.656	0.000
	DY/HR	30/16	30/ 1
	TOTAL(MBTU)	9.551	9.943
OCT	PEAK(KBTU)	51.752	118.498
	DY/HR	20/ 8	20/ 6
	TOTAL(MBTU)	10.644	42.615
NOV	PEAK(KBTU)	52.789	165.646
	DY/HR	30/ 8	2/ 6
	TOTAL(MBTU)	12.678	87.102
DEC	PEAK(KBTU)	56.274	230.960
	DY/HR	14/ 8	11/24
	ONE YEAR	129.273	379.779
	USE/PEAK	57.383	262.898

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     EMC       ENGINEERS      INC.       EZDOE - ELITE SOFTWARE DEVELOPMENT INC        DOE-2.1D   2/ 7/1995     9: 8:17  PDL RUN 1
     DENVER,         CO      80227       PROPOSED SYSTEMS FOR BLDG. #820         VEHICAL MAINT BAY
REPORT- BEPS  ESTIMATED BUILDING ENERGY PERFORMANCE                                    TOPEKA, KS
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                                ENERGY TYPE
                                IN SITE MBTU -  ELECTRICITY     NATURAL-GAS
                               CATEGORY OF USE
                                  SPACE HEAT        0.00          379.78
                                  SPACE COOL        0.00            0.00
                                  HVAC AUX         12.79            0.00
                                  DOM HOT WTR       0.00            0.00
                                  AUX SOLAR         0.00            0.00
                                  LIGHTS          116.48            0.00
                                  VERT TRANS        0.00            0.00
                                  MISC EQUIP        0.00            0.00
                                                ----------      ----------
                                   TOTAL          129.27          379.78

                    TOTAL SITE ENERGY       509.05 MBTU     48.6 KBTU/SQFT-YR GROSS-AREA     58.9 KBTU/SQFT-YR NET-AREA
                    TOTAL SOURCE ENERGY     767.99 MBTU     73.3 KBTU/SQFT-YR GROSS-AREA     88.9 KBTU/SQFT-YR NET-AREA
                    PERCENT OF HOURS ANY SYSTEM ZONE OUTSIDE OF THROTTLING RANGE =  0.0
                    PERCENT OF HOURS ANY PLANT LOAD NOT SATISFIED                =  0.0
                    NOTE  ELECTRICITY AND/OR FUEL USED TO GENERATE ELECTRICITY IS APPORTIONED BASED
                          ON THE YEARLY DEMAND.  ALL OTHER ENERGY TYPES ARE APPORTIONED HOURLY.
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BUILDING 7176
ANNUAL ENERGY SAVINGS SUMMARY

Item	Baseline	ECO	Annual Energy Savings	Adj. Annual Energy Savings*
Annual Electric (MBTU)	184.55	131.11	53.44	28.44
Annual Natural Gas (MBTU)	1010.13	853.47	156.66	83.37
Electric Demand June (KW)	14.26	14.26	0.00	0.00
Electric Demand July (KW)	14.26	14.26	0.00	0.00
Electric Demand August (KW)	14.26	14.26	0.00	0.00

*Energy savings prorated on a square foot basis:

Baseline Model Bldg 8300 (sq.ft.)	8640
ECO Model Bldg 7176 (sq.ft.)	4598
Square Footage Adjustment Factor	0.532

LIFE CYCLE COST ANALYSIS SUMMARY

ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

LOCATION:	Fort Riley	REGION: 2 (Kansas)		PROJECT NO:	1406-005
PROJECT TITLE:	Feasibility Study for HVAC Upgrade			FISCAL YEAR:	1995
ANALYSIS DATE:	05/04/95	ECONOMIC LIFE:	20	PREPARED BY:	C. Wohlert

1. INVESTMENT: **BLDG 7176 - Replace Unit Heaters w/ IR Radiant Tube Heat**

A.	CONSTRUCTION COST	=	$24,216	
B.	SIOH COST	(5.5% of 1A) =	$1,332	
C.	DESIGN COST	(6.0% of 1A) =	$1,453	
D.	TOTAL COST	(1A +1B +1C) =	$27,000	
E.	SALVAGE VALUE OF EXISTING EQUIPMENT =		$0	
F.	PUBLIC UTILITY COMPANY REBATE =		$0	
G.	TOTAL INVESTMENT	(1D -1E -1F) =	------->	$27,000

2. ENERGY SAVINGS (+) OR COST (-):

DATE OF NISTR 85-3273-9 USED FOR DISCOUNT FACTORS: JAN '95

	ENERGY SOURCE	FUEL COST $/MBTU (1)	SAVINGS MBTU/YR (2)	ANNUAL $ SAVINGS (3)	DISCOUNT FACTOR (4)	DISCOUNTED SAVINGS (5)	
A.	ELECT.	$12.10	28	$344	15.88	$5,465	
B.	DIST	$0.00	0	$0	19.16	$0	
C.	NAT GAS	$4.12	83	$343	18.30	$6,286	
D.	COAL	$0.00	0	$0	16.62	$0	
E.	ELEC. DEMAND			$0	14.88	$0	
F.	TOTAL		112	$688		-------->	$11,750

3. NON-ENERGY SAVINGS (+) OR COST (-)

A. ANNUAL RECURRING (+/-)

1 ANNUAL MAINTENANCE	$600	14.88	$8,921
2	$0	14.88	$0
3	$0	14.88	$0
4 TOTAL ANNUAL DISC. SAVINGS (+) / COST	$600		$8,921

B. NON-RECURRING (+/-)

ITEM	SAVINGS (+) COST(-) (1)	YEAR OF OCCURRENCE (2)	DISCOUNT FACTOR (3) (TABLE A-2)	DISCOUNTED SAVINGS/COST (4)
a. BASELINE EQUIP. REPLACEMEN	$24,734	5	0.863	$21,346
b.				$0
c.				$0
d.				$0
e.				$0
f. TOTAL	$24,734			$21,346

C. TOTAL NON-ENERGY DISCOUNTED SAVINGS (+) OR COST (-) (3A4 + 3Bf4) = $30,267

4.	FIRST YEAR DOLLAR SAVINGS (+) / COSTS (-)	(2F3+3A4+(3Bf1/Economic Life))	$2,524
5.	SIMPLE PAYBACK (SPB) IN YEARS (MUST BE < 10 YEARS TO QUALIFY)	(1G/4) =	10.70
6.	TOTAL NET DISCOUNTED SAVINGS	(2F5 + 3C) =	$42,017
7.	DISCOUNTED SAVINGS-TO-INVESTMENT RATIO (SIR) (MUST HAVE SIR > 1.25 TO QUALIFY)	(6/1G) =	1.56

ENGINEER'S OPINION OF PROBABLE COST

PROJECT	Fort Riley Feasibility Study for HVAC Upgrade	**SHEET**	1 OF 1
ENGINEER	E M C Engineers, Inc.	**DATE PREPARED**	4-May-95
	Denver, CO	**ESTIMATOR**	C. Wohlert
		CHECKED BY	A. Niemeyer

Line No.	Item Refer Code	Item Description	Unit of Measure	MATERIAL COST Quantity	MATERIAL COST Unit Cost	MATERIAL COST Total	LABOR COST Crew/ Worker	LABOR COST Hours/ Unit	LABOR COST Total	TOTAL
1		**BUILDING 7176**								
2		**PROPOSED SYSTEM MODIFICATIONS**								
3										
4		*NEW SYSTEMS INSTALLATION*								
5	STLPIP2	STEEL PIPE SCH. 40, 2" W/HANGERS	L.F.	180.0	$3.91	$705	Q-1	0.25	$873	$1,577
6		VALVES AND FITTINGS ADD 15%				$106			$131	$237
7	IRHEAT	GAS FIRED IR TUBE SYSTEMS / BURNER	EA.	5.0	$1,564.94	$7,825	Q-6	18.24	$1,834	$9,658
8	IRHT30	GAS FIRED IR HEATER, 30 MBH	EA.	2.0	$324.62	$649	Q-5	2.667	$103	$753
9	ELCND1	ELECTRICAL CONDUIT 1"	L.F.	120.0	$0.83	$100	1-ELEC	0.064	$161	$261
10	WIRE#6	COPPER WIRING #6	C.L.F.	1.0	$24.71	$25	1-ELEC	1.231	$26	$50
11	GASCN	FLEXIBLE CONNECTOR 12" LONG	EA.	7.0	$7.90	$55	1-PLUM	0.222	$33	$89
12										
13		*EXISTING SYSTEMS DEMOLITION*								
14		BOILER DEMOLITION	EA.	1.0			Q-6	12	$241	$241
15		UNIT HEATER DEMOLITION	TON	1.1			Q-5	14.545	$310	$310
16		STEAM PIPING DEMOLITION	L.F.	200.0			1-PLUM	0.04	$172	$172
17		ASBESTOS REMOVAL	GLV. BAG	10.0	$170.00	$1,700				$1,700
18		ASBESTOS REMOVAL ON PIPE	L.F.	200.0	$3.29	$658				$658
19										
20										
21										
22										
23										
24										
25										
26										
27										
28										
29										
30										
31		**SUBTOTAL**				$11,822			$3,884	$15,707
32	OH	OVERHEAD			17%	$1,986			$653	$2,639
33	PRO	PROFIT			10%	$1,381			$454	$1,835
34	CONT	CONTINGENCY			20%	$3,038			$998	$4,036
35	**TOTAL COST**		-	-	-	$18,227	-	-	$5,989	$24,216

ENGINEER'S OPINION OF PROBABLE COST

PROJECT	Fort Riley Feasibility Study for HVAC Upgrade	**SHEET**	1 **OF** 1
		DATE PREPARED	4-May-95
ENGINEER	E M C Engineers, Inc.	**ESTIMATOR**	C. Wohlert
	Denver, CO	**CHECKED BY**	A. Niemeyer

Line No.	Item Refer Code	Item Description	Unit of Measure	MATERIAL COST Quantity	MATERIAL COST Unit Cost	MATERIAL COST Total	LABOR COST Crew/ Worker	LABOR COST Hours/ Unit	LABOR COST Total	TOTAL
1		**BUILDING 7176**								
2		**NON-RECURRING**								
3										
4		*BASELINE - EXISTING EQUIP. REPLACEMENT*								
5	STMBLR1	1,000 MBH STEAM BOILER (Cast Iron)	EA.	1.0	$6,686.10	$6,686	Q-7	80	$1,644	$8,330
6	STLPIP1.5	STEEL PIPE SCH. 40, 1.5" W/HANGERS	L.F.	190.0	$2.95	$560	Q-1	0.2	$737	$1,297
7	STLPIP4	STEEL PIPE SCH. 40, 4" W/HANGERS	L.F.	10.0	$9.16	$92	Q-15	0.432	$84	$175
8	FTR1.25S	FINNED TUBE RAD. - 1.25" STEEL TUBE, STEEL FI	L.F.	20.0	$28.59	$572	Q-1	0.444	$172	$744
9	UH9	HORIZ. UNIT HEATER, PROPELLER, 133.3 MBH	EA.	5.0	$901.17	$4,506	Q-5	3.2	$310	$4,816
10										
11										
12										
13		*EXISTING SYSTEMS DEMOLITION*								
14		BOILER DEMOLITION	EA.	1.0			Q-6	12	$241	$241
15		UNIT HEATER DEMOLITION	TON	1.1			Q-5	14.545	$310	$310
16		STEAM PIPING DEMOLITION	L.F.	200.0			PLUM	0.04	$129	$129
17										
18										
19										
20										
21										
22										
23										
24										
25										
26										
27										
28										
29										
30										
31		**SUBTOTAL**				$12,415			$3,628	$16,043
32	OH	OVERHEAD			17%	$2,086			$609	$2,695
33	PRO	PROFIT			10%	$1,450			$424	$1,874
34	CONT	CONTINGENCY			20%	$3,190			$932	$4,122
35	**TOTAL COST**		-	-	-	$19,141	-	-	$5,593	$24,734

ENGINEER'S OPINION OF PROBABLE COST

PROJECT	Fort Riley Feasibility Study for HVAC Upgrade	SHEET 1 OF 1	
ENGINEER	E M C Engineers, Inc.	DATE PREPARED	4-May-95
	Denver, CO	ESTIMATOR	C. Wohlert
		CHECKED BY	A. Niemeyer

Line No.	Item Refer Code	Item Description	Unit of Measure	MATERIAL COST Quantity	MATERIAL COST Unit Cost	MATERIAL COST Total	LABOR COST Crew/ Worker	LABOR COST Hours/ Unit	LABOR COST Total	TOTAL
1		**BUILDING 7176**								
2		***ANNUAL RECURRING***								
3		***ANNUAL MAINTENANCE COST - BASELINE***								
4	MNT-BLR	MAINT. ON BOILERS - >2.5 MBH	EA.	1.0	$96.90	$97	Q-6	25	$503	$600
5	MNT-UH	MAINT. ON UHS - INSPEC. / YR	EA.	5.0			Q-6	4	$402	$402
6										
7										
8										
9										
10										
11										
12										
13										
14										
15	**TOTAL ANNUAL MAINTENANCE COST - BASELINE**		-	-	-	$97	-	-	$905	$1,002
16										
17		***ANNUAL MAINTENANCE COST - NEW HVAC REPLACEMENT***								
18	MNT-IR	MAINT. ON IR HEATERS - INSPEC. / YR	EA.	5.0			Q-6	4	$402	$402
19										
20										
21										
22										
23										
24										
25										
26										
27										
28										
29	**TOTAL ANNUAL MAINTENANCE COST - BASELINE**		-	-	-	$0	-	-	$402	$402
30										
31										
32										
33										
34										
35	**TOTAL ANNUAL MAINTENANCE COST SAVINGS**		-	-	-	$97	-	-	$503	$600

REPORT- LV-D DETAILS OF EXTERIOR SURFACES IN THE PROJECT

NUMBER OF EXTERIOR SURFACES 4 RECTANGULAR 4 OTHER 0
(U-VALUE INCLUDES INSIDE AIR FILM PLUS OUTSIDE AIR FILM AT 7.5 MPH WINDSPEED)

SURFACE	SPACE	GLASS U-VALUE (BTU/HR-SQFT-F)	GLASS AREA (SQFT)	WALL U-VALUE (BTU/HR-SQFT-F)	WALL AREA (SQFT)	WALL+GLASS U-VALUE (BTU/HR-SQFT-F)	WALL+GLASS AREA (SQFT)	AZIMUTH
	BAY-AREA	0.000	0.00	0.133	3600.00	0.133	3600.00	NORTH-EAST
	BAY-AREA	0.490	56.00	0.133	3544.00	0.139	3600.00	SOUTH-WEST
	BAY-AREA	0.490	266.00	0.133	1234.00	0.196	1500.00	NORTH-WEST
	BAY-AREA	0.000	0.00	0.092	7440.00	0.092	7440.00	ROOF
	BAY-AREA	0.000	0.00	0.020	7440.00	0.020	7440.00	UNDERGRND

EMC ENGINEERS INC. EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/ 7/1995 13:23: 7 LDL RUN 1
DENVER, CO 80227 EXISTING CONDITION FOR BLDG. #7176 VEHICAL MAINT BAY
TOPEKA, KS
REPORT- LV-D DETAILS OF EXTERIOR SURFACES IN THE PROJECT

	AVERAGE U-VALUE/GLASS (BTU/HR-SQFT-F)	AVERAGE U-VALUE/WALLS (BTU/HR-SQFT-F)	AVERAGE U-VALUE WALLS+GLASS (BTU/HR-SQFT-F)	GLASS AREA (SQFT)	OPAQUE AREA (SQFT)	GLASS+OPAQUE AREA (SQFT)
NORTH-EAST	0.000	0.133	0.133	0.00	3600.00	3600.00
SOUTH-WEST	0.490	0.133	0.139	56.00	3544.00	3600.00
NORTH-WEST	0.490	0.133	0.196	266.00	1234.00	1500.00
ROOF	0.000	0.092	0.092	0.00	7440.00	7440.00
ALL WALLS	0.490	0.133	0.146	322.00	8378.00	8700.00
WALLS+ROOFS	0.490	0.114	0.121	322.00	15818.00	16140.00
UNDERGRND	0.000	0.020	0.020	0.00	7440.00	7440.00
BUILDING	0.490	0.084	0.089	322.00	23258.00	23580.00

REPORT- LS-C BUILDING PEAK LOAD COMPONENTS

*** BUILDING ***

FLOOR AREA	8640	SQFT	803	SQMT
VOLUME	216000	CUFT	6117	CUMT

	COOLING LOAD		HEATING LOAD	
TIME	SEP 6	4PM	DEC 8	1PM
DRY-BULB TEMP	93F	34C	20F	-7C
WET-BULB TEMP	76F	24C	17F	-8C

	COOLING SENSIBLE (KBTU/H)	COOLING SENSIBLE (KW)	COOLING LATENT (KBTU/H)	COOLING LATENT (KW)	HEATING SENSIBLE (KBTU/H)	HEATING SENSIBLE (KW)
WALLS	20.461	5.993	0.000	0.000	-33.326	-9.760
ROOFS	21.857	6.401	0.000	0.000	-30.484	-8.928
GLASS CONDUCTION	3.833	1.122	0.000	0.000	-7.984	-2.338
GLASS SOLAR	8.789	2.574	0.000	0.000	3.614	1.058
DOOR	19.780	5.793	0.000	0.000	-28.776	-8.428
INTERNAL SURFACES	0.000	0.000	0.000	0.000	0.000	0.000
UNDERGROUND SURFACES	-0.055	-0.016	0.000	0.000	-2.656	-0.778
OCCUPANTS TO SPACE	8.857	2.594	17.500	5.125	8.670	2.539
LIGHT TO SPACE	36.907	10.809	0.000	0.000	35.571	10.418
EQUIPMENT TO SPACE	0.000	0.000	0.000	0.000	0.000	0.000
PROCESS TO SPACE	0.000	0.000	0.000	0.000	0.000	0.000
INFILTRATION	507.805	148.723	647.265	189.568	-1265.722	-370.698
TOTAL	628.234	183.994	664.765	194.693	-1321.092	-386.915
TOTAL LOAD	1292.998 KBTU/H		378.687 KW		-1321.092 KBTU/H	-386.915 KW
TOTAL LOAD / AREA	149.65BTU/H.SQFT		471.777 W /SQMT		152.904BTU/H.SQFT	482.028 W /SQMT

NOTE 1)THE ABOVE LOADS EXCLUDE OUTSIDE VENTILATION AIR LOADS
2)TIMES GIVEN IN STANDARD TIME FOR THE LOCATION IN CONSIDERATION

EMC ENGINEERS INC. EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/ 7/1995 13:23: 7 SDL RUN 1
DENVER, CO 80227 EXISTING CONDITION FOR BLDG. #7176 VEHICAL MAINT BAY
REPORT- SS-A SYSTEM MONTHLY LOADS SUMMARY FOR UNIT-HEATS TOPEKA, KS

	COOLING						HEATING						ELEC	
MONTH	COOLING ENERGY (MBTU)	TIME OF MAX DY	HR	DRY-BULB TEMP	WET-BULB TEMP	MAXIMUM COOLING LOAD (KBTU/HR)	HEATING ENERGY (MBTU)	TIME OF MAX DY	HR	DRY-BULB TEMP	WET-BULB TEMP	MAXIMUM HEATING LOAD (KBTU/HR)	ELEC-TRICAL ENERGY (KWH)	MAXIMUM ELEC LOAD (KW)
JAN	0.00000					0.000	-152.395	4	10	8.F	7.F	-1153.493	2975.	15.141
FEB	0.00000					0.000	-108.869	14	10	30.F	27.F	-972.041	2666.	15.141
MAR	0.00000					0.000	-94.123	3	9	17.F	13.F	-1117.751	3194.	15.141
APR	0.00000					0.000	-34.033	4	10	34.F	31.F	-860.876	2871.	15.030
MAY	0.00000					0.000	-5.651	4	17	55.F	53.F	-397.961	2847.	14.560
JUN	0.00000					0.000	0.000					0.000	2978.	14.250
JUL	0.00000					0.000	0.000					0.000	2708.	14.250
AUG	0.00000					0.000	0.000					0.000	3114.	14.250
SEP	0.00000					0.000	0.000					0.000	2843.	14.250
OCT	0.00000					0.000	-24.799	19	11	39.F	32.F	-750.751	2728.	14.920
NOV	0.00000					0.000	-64.337	1	15	36.F	28.F	-889.781	2762.	15.062
DEC	0.00000					0.000	-140.368	8	13	20.F	17.F	-1187.388	2964.	15.141
TOTAL	0.000						-624.576						34649.	
MAX						0.000						-1187.388		15.141

EMC ENGINEERS INC. EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/ 7/1995 13:23: 7 SDL RUN 1
DENVER, CO 80227 EXISTING CONDITION FOR BLDG. #7176 VEHICAL MAINT BAY
REPORT- SS-C SYSTEM MONTHLY LOAD HOURS FOR UNIT-HEATS TOPEKA, KS

	NUMBER OF HOURS										COINCIDENT LOADS	
MONTH	HOURS COOLING LOAD	HOURS HEATING LOAD	HOURS COINCIDENT COOL-HEAT LOAD	HOURS FLOATING	HOURS HEATING AVAIL.	HOURS COOLING AVAIL.	HOURS FANS ON	HOURS FANS CYCLE ON	HOURS NIGHT VENTING	HOURS FLOATING WHEN FANS ON	HEATING LOAD AT COOLING PEAK (KBTU/HR)	ELECTRIC LOAD AT COOLING PEAK (KW)
JAN	0	384	0	360	744	0	384	384	0	0	-204.980	0.169
FEB	0	336	0	336	672	0	336	336	0	0	-203.837	0.169
MAR	0	370	0	374	744	0	370	370	0	0	-254.702	0.215
APR	0	231	0	489	720	0	278	278	0	47	-40.040	0.031
MAY	0	62	0	682	360	0	194	194	0	132	0.000	0.000
JUN	0	0	0	720	0	0	0	0	0	0	0.000	0.000
JUL	0	0	0	744	0	0	0	0	0	0	0.000	0.000
AUG	0	0	0	744	0	0	0	0	0	0	0.000	0.000
SEP	0	0	0	720	0	0	0	0	0	0	0.000	0.000
OCT	0	212	0	532	720	0	272	272	0	60	0.000	0.000
NOV	0	330	0	390	720	0	333	333	0	3	0.000	0.000
DEC	0	382	0	362	744	0	382	382	0	0	0.000	0.000
ANNUAL	0	2307	0	6453	5424	0	2549	2549	0	242		

EMC ENGINEERS INC. EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/ 7/1995 13:23: 7 PDL RUN 1
DENVER, CO 80227 EXISTING CONDITION FOR BLDG. #7176 VEHICAL MAINT BAY
REPORT- PS-B MONTHLY PEAK AND TOTAL ENERGY USE TOPEKA, KS

MO	UTILITY-	ELECTRICITY	NATURAL-GAS
	TOTAL(MBTU)	23.163	238.950
JAN	PEAK(KBTU)	88.871	1543.960
	DY/HR	27/16	4/10
	TOTAL(MBTU)	20.113	177.244
FEB	PEAK(KBTU)	88.871	1337.701
	DY/HR	14/10	14/10
	TOTAL(MBTU)	21.488	154.397
MAR	PEAK(KBTU)	88.871	1503.793
	DY/HR	3/11	3/ 9
	TOTAL(MBTU)	14.927	57.420
APR	PEAK(KBTU)	88.493	1208.451
	DY/HR	4/10	4/10
	TOTAL(MBTU)	10.891	9.920
MAY	PEAK(KBTU)	86.888	646.644
	DY/HR	4/11	4/17
	TOTAL(MBTU)	10.169	0.000
JUN	PEAK(KBTU)	48.656	0.000
	DY/HR	30/16	30/ 1
	TOTAL(MBTU)	9.245	0.000
JUL	PEAK(KBTU)	48.656	0.000
	DY/HR	29/16	31/ 1
	TOTAL(MBTU)	10.631	0.000
AUG	PEAK(KBTU)	48.656	0.000
	DY/HR	31/16	31/ 1
	TOTAL(MBTU)	9.707	0.000
SEP	PEAK(KBTU)	48.656	0.000
	DY/HR	30/16	30/ 1
	TOTAL(MBTU)	13.577	42.222
OCT	PEAK(KBTU)	88.116	1078.248
	DY/HR	19/11	19/11
	TOTAL(MBTU)	17.870	107.824
NOV	PEAK(KBTU)	88.604	1242.270
	DY/HR	1/15	1/15
	TOTAL(MBTU)	22.764	222.157
DEC	PEAK(KBTU)	88.871	1581.841
	DY/HR	30/14	8/13
	ONE YEAR	184.545	1010.134
	USE/PEAK	88.871	1581.841

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EMC       ENGINEERS      INC.       EZDOE - ELITE SOFTWARE DEVELOPMENT INC        DOE-2.1D   2/ 7/1995     13:23: 7  PDL RUN 1
  DENVER,        CO         80227      EXISTING CONDITION FOR BLDG. #7176       VEHICAL MAINT BAY
REPORT- BEPS  ESTIMATED BUILDING ENERGY PERFORMANCE                                  TOPEKA, KS
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ENERGY TYPE IN SITE MBTU - CATEGORY OF USE	ELECTRICITY	NATURAL-GAS
SPACE HEAT	40.84	1010.13
SPACE COOL	0.00	0.00
HVAC AUX	27.22	0.00
DOM HOT WTR	0.00	0.00
AUX SOLAR	0.00	0.00
LIGHTS	116.48	0.00
VERT TRANS	0.00	0.00
MISC EQUIP	0.00	0.00
TOTAL	184.55	1010.13

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TOTAL SITE ENERGY      1194.68 MBTU    114.1 KBTU/SQFT-YR GROSS-AREA    138.3 KBTU/SQFT-YR NET-AREA
TOTAL SOURCE ENERGY    1564.32 MBTU    149.3 KBTU/SQFT-YR GROSS-AREA    181.1 KBTU/SQFT-YR NET-AREA
PERCENT OF HOURS ANY SYSTEM ZONE OUTSIDE OF THROTTLING RANGE =  8.3
PERCENT OF HOURS ANY PLANT LOAD NOT SATISFIED                =  0.0
NOTE  ELECTRICITY AND/OR FUEL USED TO GENERATE ELECTRICITY IS APPORTIONED BASED
      ON THE YEARLY DEMAND.  ALL OTHER ENERGY TYPES ARE APPORTIONED HOURLY.
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EMC       ENGINEERS      INC.      EZDOE - ELITE SOFTWARE DEVELOPMENT INC       DOE-2.1D    2/ 9/1995    16:16:54  SDL RUN 1
 DENVER,      CO        80227      PROPOSED UP-GRADE FOR BLDG. #7176          VEHICAL MAINT BAY
REPORT- SS-A  SYSTEM MONTHLY LOADS SUMMARY FOR                 GAS_IR                  TOPEKA, KS
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	- - - - - - - - - C O O L I N G - - - - - - - - -					- - - - - - - - - H E A T I N G - - - - - - - - -						- - - E L E C - - -	
MONTH	COOLING ENERGY (MBTU)	TIME OF MAX DY	HR	DRY-BULB TEMP	WET-BULB TEMP	MAXIMUM COOLING LOAD (KBTU/HR)	HEATING ENERGY (MBTU)	TIME OF MAX DY	HR	DRY-BULB TEMP	WET-BULB TEMP	MAXIMUM HEATING LOAD (KBTU/HR)	ELEC-TRICAL ENERGY (KWH)	MAXIMUM ELEC LOAD (KW)
JAN	0.00000					0.000	-161.324	14	9	-3.F	-4.F	-1209.730	2843.	14.250
FEB	0.00000					0.000	-114.568	14	10	30.F	27.F	-775.229	2572.	14.250
MAR	0.00000					0.000	-95.488	3	8	15.F	12.F	-989.212	3114.	14.250
APR	0.00000					0.000	-29.269	4	10	34.F	31.F	-672.389	2843.	14.250
MAY	0.00000					0.000	-3.843	5	8	46.F	41.F	-233.841	2843.	14.250
JUN	0.00000					0.000	0.000					0.000	2978.	14.250
JUL	0.00000					0.000	0.000					0.000	2708.	14.250
AUG	0.00000					0.000	0.000					0.000	3114.	14.250
SEP	0.00000					0.000	0.000					0.000	2843.	14.250
OCT	0.00000					0.000	-21.190	19	10	38.F	34.F	-582.407	2708.	14.250
NOV	0.00000					0.000	-64.499	30	8	28.F	25.F	-638.875	2708.	14.250
DEC	0.00000					0.000	-146.027	8	13	20.F	17.F	-1193.378	2843.	14.250
TOTAL	0.000						-636.209						34115.	
MAX						0.000						-1209.730		14.250

D8-40

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EMC       ENGINEERS      INC.      EZDOE - ELITE SOFTWARE DEVELOPMENT INC       DOE-2.1D    2/ 9/1995    16:16:54  SDL RUN 1
 DENVER,      CO        80227      PROPOSED UP-GRADE FOR BLDG. #7176          VEHICAL MAINT BAY
REPORT- SS-C  SYSTEM MONTHLY LOAD HOURS FOR                    GAS_IR                  TOPEKA, KS
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	- - - - - - - - - - - - - - - - - - N U M B E R O F H O U R S - - - - - - - - - - - - - - - - - -									--COINCIDENT LOADS--	
MONTH	HOURS COOLING LOAD	HOURS HEATING LOAD	HOURS COINCIDENT COOL-HEAT LOAD	HOURS FLOATING	HOURS HEATING AVAIL.	HOURS COOLING AVAIL.	HOURS FANS ON	HOURS FANS CYCLE ON	HOURS NIGHT VENTING	HOURS FLOATING WHEN FANS ON	HEATING LOAD AT COOLING PEAK (KBTU/HR)	ELECTRIC LOAD AT COOLING PEAK (KW)
JAN	0	744	0	0	744	744	744	0	0	0	-97.173	0.000
FEB	0	671	0	1	672	672	672	0	0	1	-96.123	0.000
MAR	0	710	0	34	744	744	744	0	0	34	-96.846	0.000
APR	0	325	0	395	720	720	720	0	0	395	0.000	0.000
MAY	0	76	0	668	360	744	360	0	0	284	0.000	0.000
JUN	0	0	0	720	0	720	0	0	0	0	0.000	0.000
JUL	0	0	0	744	0	744	0	0	0	0	0.000	0.000
AUG	0	0	0	744	0	744	0	0	0	0	0.000	0.000
SEP	0	0	0	720	0	720	0	0	0	0	0.000	0.000
OCT	0	290	0	454	720	744	720	0	0	430	-68.154	0.000
NOV	0	580	0	140	720	720	720	0	0	140	-107.993	0.000
DEC	0	743	0	1	744	744	744	0	0	1	-107.135	0.000
ANNUAL	0	4139	0	4621	5424	8760	5424	0	0	1285		

EMC ENGINEERS INC. EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/ 9/1995 16:16:54 PDL RUN 1
DENVER, CO 80227 PROPOSED UP-GRADE FOR BLDG. #7176 VEHICAL MAINT BAY
REPORT- PS-B MONTHLY PEAK AND TOTAL ENERGY USE TOPEKA, KS

MO	UTILITY-	ELECTRICITY	NATURAL-GAS
	TOTAL(MBTU)	13.417	207.320
JAN	PEAK(KBTU)	76.480	1342.800
	DY/HR	14/ 9	14/ 9
	TOTAL(MBTU)	11.417	152.426
FEB	PEAK(KBTU)	66.486	904.349
	DY/HR	14/10	14/10
	TOTAL(MBTU)	12.827	130.745
MAR	PEAK(KBTU)	71.408	1125.162
	DY/HR	3/ 8	3/ 8
	TOTAL(MBTU)	10.380	42.944
APR	PEAK(KBTU)	64.121	794.853
	DY/HR	4/10	4/10
	TOTAL(MBTU)	9.795	6.521
MAY	PEAK(KBTU)	54.034	303.345
	DY/HR	5/ 8	5/ 8
	TOTAL(MBTU)	10.169	0.000
JUN	PEAK(KBTU)	48.656	0.000
	DY/HR	30/16	30/ 1
	TOTAL(MBTU)	9.245	0.000
JUL	PEAK(KBTU)	48.656	0.000
	DY/HR	29/16	31/ 1
	TOTAL(MBTU)	10.631	0.000
AUG	PEAK(KBTU)	48.656	0.000
	DY/HR	31/16	31/ 1
	TOTAL(MBTU)	9.707	0.000
SEP	PEAK(KBTU)	48.656	0.000
	DY/HR	30/16	30/ 1
	TOTAL(MBTU)	9.732	32.516
OCT	PEAK(KBTU)	62.051	697.252
	DY/HR	19/10	19/10
	TOTAL(MBTU)	10.728	91.211
NOV	PEAK(KBTU)	63.350	758.697
	DY/HR	30/ 8	30/ 8
	TOTAL(MBTU)	13.065	189.783
DEC	PEAK(KBTU)	76.103	1327.008
	DY/HR	8/13	8/13
	ONE YEAR	131.115	853.466
	USE/PEAK	76.480	1342.800

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EMC       ENGINEERS      INC.       EZDOE - ELITE SOFTWARE DEVELOPMENT INC       DOE-2.1D   2/ 9/1995    16:16:54  PDL RUN 1
  DENVER,       CO       80227      PROPOSED UP-GRADE FOR BLDG. #7176      VEHICAL MAINT BAY
REPORT- BEPS  ESTIMATED BUILDING ENERGY PERFORMANCE                               TOPEKA, KS
```

ENERGY TYPE IN SITE MBTU - CATEGORY OF USE	ELECTRICITY	NATURAL-GAS
SPACE HEAT	0.00	853.47
SPACE COOL	0.00	0.00
HVAC AUX	14.63	0.00
DOM HOT WTR	0.00	0.00
AUX SOLAR	0.00	0.00
LIGHTS	116.48	0.00
VERT TRANS	0.00	0.00
MISC EQUIP	0.00	0.00
TOTAL	131.11	853.47

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TOTAL SITE ENERGY       984.58 MBTU     94.0 KBTU/SQFT-YR GROSS-AREA    114.0 KBTU/SQFT-YR NET-AREA
TOTAL SOURCE ENERGY    1247.20 MBTU    119.1 KBTU/SQFT-YR GROSS-AREA    144.4 KBTU/SQFT-YR NET-AREA
PERCENT OF HOURS ANY SYSTEM ZONE OUTSIDE OF THROTTLING RANGE =  0.0
PERCENT OF HOURS ANY PLANT LOAD NOT SATISFIED                =  0.0
NOTE  ELECTRICITY AND/OR FUEL USED TO GENERATE ELECTRICITY IS APPORTIONED BASED
      ON THE YEARLY DEMAND.  ALL OTHER ENERGY TYPES ARE APPORTIONED HOURLY.
```

Slash fuel bills up to 50% and more by reducing fuel consumption

CO-RAY-VAC uses less fuel than other heating systems. Because less fuel is used, heating bills are lower. These fuel savings are due to the sum of four major factors:

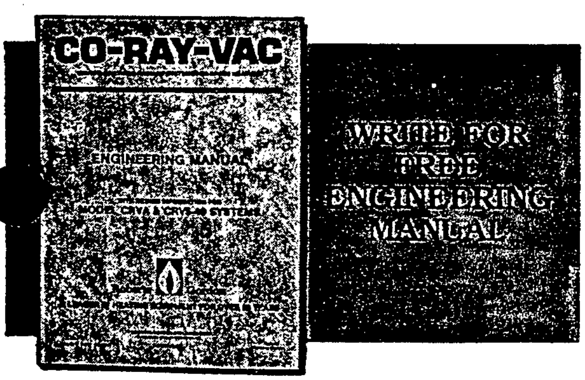
■ High Combustion Efficiency
The patented CO-RAY-VAC system is the only gas-fired, vacuum vented, tube type radiant heating system manufactured in the U.S.A. that has burners firing in series to produce more uniform heat. With exhaust temperatures of 150° to 200° F, it achieves a combustion efficiency in the range of 90%. Unit heaters and central heating systems with exhaust temperatures of 500°-600° F have combustion efficiencies of 60-75%. CO-RAY-VAC's high combustion efficiency turns almost every BTU generated into usable heat.

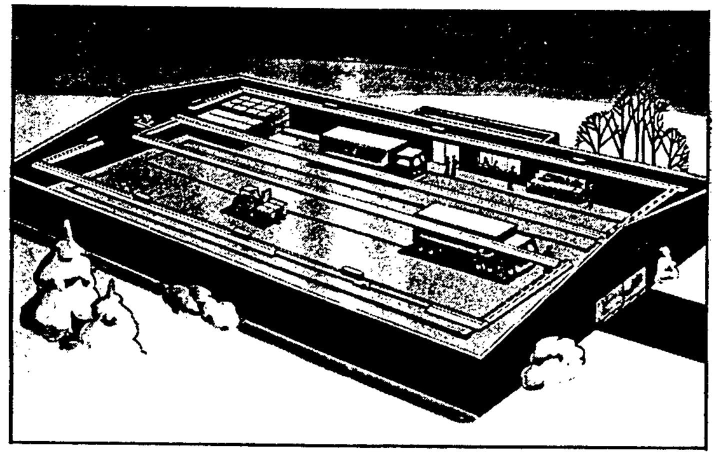
■ Less Heat Stratification
CO-RAY-VAC beams its heat downward to people, floors and objects. The floors and objects become reservoirs of heat so when open doors are closed, comfort conditions are quickly regained. With warm air systems, air is heated and rises causing cold conditions at floor level and stratification of warm air at the roof. CO-RAY-VAC drastically reduces heat stratification.

■ Comfort at Lower Temperatures
CO-RAY-VAC users report that inside air temperatures have been kept 5-10° lower while maintaining the same comfort level.

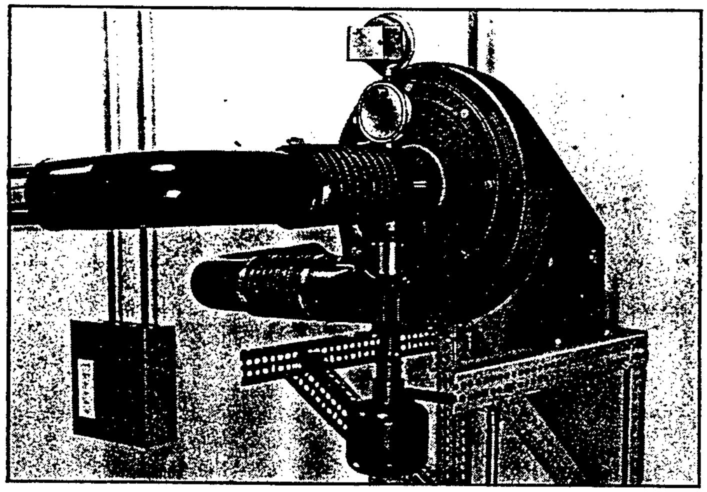
■ Reduced Building Heat Loss
CO-RAY-VAC's vacuum pump closes the system when it is not firing, so there is no heat lost out the exhaust tubes. Standard direct spark ignition means there are no standing pilots to waste fuel.

How a Typical CO-RAY-VAC Heating Installation Works
The system consists of a number of burners connected by tubes which radiate heat. The entire system is suspended from the ceiling. Metal reflectors over the tubes direct heat downward, warming people and objects below. There is no blowing of air to create warm and cold spots or to stir up dust and dirt. At the end of the system a powerful exhauster expels the by-products of combustion outdoors.

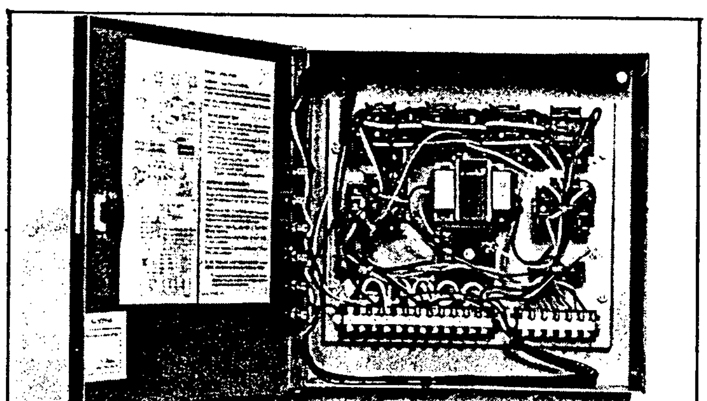




CO-RAY-VAC Annual Fuel Utilization Efficiency (AFUE) has been verified at 90.43% by Gas Consultants Inc. and independent testing laboratory.



Exhauster: A heavy, cast-iron vacuum pump located at the end of the system draws the heat through the system, and completely exhausts all the products of combustion to the outdoors at temperatures usually below 200° F.



Pre-Wired Control Panel: CO-RAY-VAC heating systems are controlled by a pre-wired control panel. These panels are assembled and tested at the factory to reduce installation labor. The panel contains 4 zone relays which allow the system to be divided into separate heating areas each with its own thermostat.

CO-RAY-VAC Specifications

Natural or LP Gas

Factory Furnished Components

All components are heavy-duty type to insure long life and minimum maintenance.

Equipment supplied by Roberts-Gordon consists of the following components:

- Durable steel or cast iron combustion chambers
- Burner controls and cast iron burner
- Pipe and Reflector Hangers
- Aluminum reflectors
- Vacuum pumps
- Pre-wired control panel
- Thermostats
- Radiant Pipe (between burners): 4" 16 gauge steel for CRV-B series (supplied); 4" schedule 40 steel optional (not supplied)
- Balance of Pipe: 4" 16 gauge steel with porcelain interior for all models
- OPTIONAL: • perimeter-type reflectors for use in crane areas, etc.
- Decorative grilles with specially designed reflectors

Engineering Data

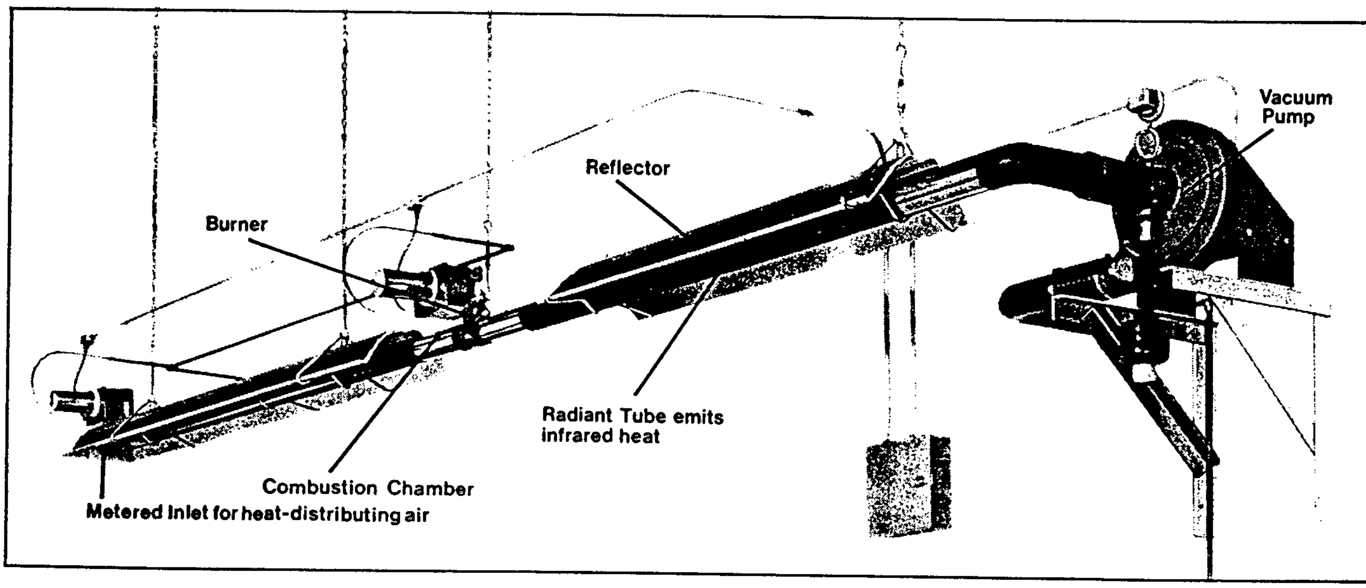
Pressure: Natural Gas: 4.5 W.C.; L.P. Gas: 11" W.C. Burner: 115V AC, 60 Hz current required for each burner: amperage .30. Vacuum Pump Motor: 115V AC, 60 Hz, 3450 RPM ¾ HP TEFC capacitor single phase ball-bearing thermally-protected.

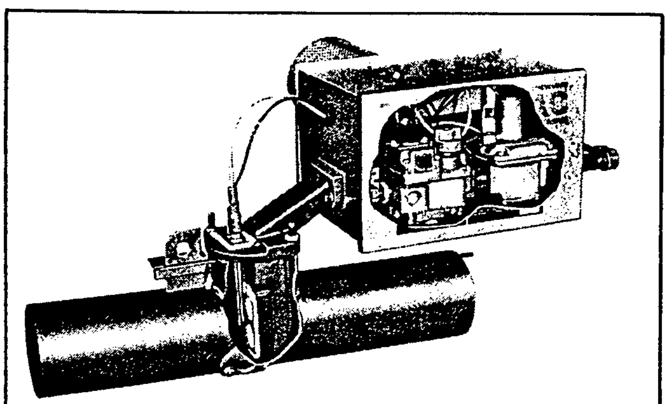
TABLE OF MINIMUM CLEARANCES TO COMBUSTIBLE MATERIALS

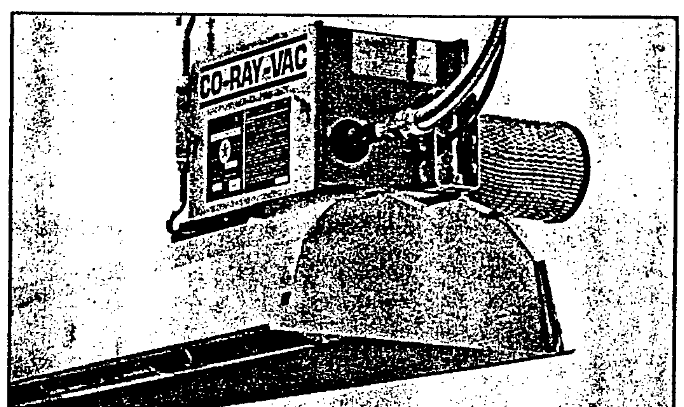
	MODELS CRV-B (2), (4), (6), (8)			MODELS CRV-B (10), (12)		
REFLECTOR TYPE	SIDE	TOP	BELOW	SIDE	TOP	BELOW
STANDARD REFLECTOR	26	4	48	36	4	60
W/ONE SIDE EXTENSION	26	4	56	42	4	60
W/TWO SIDE EXTENSION		4	56		4	60
1 FT. WIDE W/GRILLE	12	4	48	18	4	56
2 FT. WIDE W/GRILLE	12	4	48	18	4	56
STANDARD SYSTEM (Downstream from Burner) (Note 1)						
W/STANDARD REFLECTOR	10	4	18	18	4	24

NOTES: 1. CLEARANCES FROM TUBE AS SHOWN APPLY ONLY DOWNSTREAM FROM BURNERS AS FOLLOWS:
CRV-B2, 4, 6, 8 OVER 20 FEET DOWNSTREAM.
CRV-B10, 12 OVER 30 FEET DOWNSTREAM.

Patents and patents pending in United States, Canada, United Kingdom and free Europe. Specifications shown are subject to change without notice







Burners: CO-RAY-VAC unique burners constantly regulate the air-to-gas mixture to achieve the very best ratio for clean, efficient combustion. Each burner is in effect a miniature furnace occupying a space about 1 ft. high by 1½ ft. long. CO-RAY-VAC is the only AGA certified system that has burners firing one after the other down the same length of tube. This unique design provides higher levels of comfort and heat uniformity.

Radiant Tubes and Reflectors: The burners are located about 20' apart and are connected by radiant tubes. The heat created by the burners is drawn through the tubes, which radiate warmth. Aluminum reflectors reflect heat towards the floor where it is most needed.

Burner Model No.	CRV B-4	CRV B-6	CRV B-8	CRV B-10	CRV ~~B-12~~ B-11
Input BTU/Hr (1000's)	40	60	80	100	~~120~~ 110
Flow Units per Burner	4	6	8	10	~~12~~ 11
Flow Units per End Vent	10	15	20	20	20
Maximum No. Burners per Branch	4	4	3	3	2
Maximum Flow Units per Branch	26	39	44	50	44
Radiant Tube Length (Distance Between Burners)					
Minimum (ft.)	12.5	20	25	30	35
Maximum (ft.)	25	35	45	60	70
Tailpipe Length per Flow Unit					
Minimum (ft.)	1.2	1.2	1.2	1.2	1.2
Maximum (ft.)	3.0	3.0	3.0	3.0	3.0
Minimum Tube Length from Burner					
Downstream to Elbow (ft.)	5	10	10	15	15
Upstream to Elbow (ft.)	2	2	2	2	2
Suggested Minimum Mounting Height (ft.)	8	8	10	15	15

FIGURE 3: Design Parameters

2/1/95 | Phone Contact

CRV - B-11 Btu

Carl Becker
CoRay Vac
279-4971

110 Burners Can put up to 6 burners/fan

[$ 2,000/Burner
small quantities
Material only]

Large quantities
$3,000/Burner = material $1,900/Burner + labor $1,100/Burner

B-2 = 20 mBH
B-4 = 40 mBH
B-6 = 60 mBH
B-8 = 80 mBh
B-10 = 100 mBh
B-11 = 6/Vac pump max 110 mBH used to be the 120 mBH model But do not make 120 mBH models any longer.

BUILDING 202
ANNUAL ENERGY SAVINGS SUMMARY

Item	Baseline	ECO	Annual Energy Savings	Adj. Annual Energy Savings*
Annual Electric (MBTU)	567.15	550.60	16.55	19.53
Annual Natural Gas (MBTU)	618.86	493.62	125.24	147.77
Electric Demand June (KW)	28.31	27.54	0.77	0.91
Electric Demand July (KW)	28.31	27.54	0.77	0.91
Electric Demand August (KW)	28.31	27.54	0.77	0.91

*Energy savings prorated on a square foot basis:

Baseline Model Bldg 8069 (sq.ft.)	10101
ECO Model Bldg 202 (sq.ft.)	11918
Square Footage Adjustment Factor	1.180

LIFE CYCLE COST ANALYSIS SUMMARY
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

LOCATION:	Fort Riley	REGION: 2 (Kansas)		PROJECT NO:	1406-005
PROJECT TITLE:	Feasibility Study for HVAC Upgrade			FISCAL YEAR:	1995
ANALYSIS DATE:	05/04/95	ECONOMIC LIFE:	20	PREPARED BY:	C. Wohlert

1. INVESTMENT: **BLDG 202 - Replace STM UHs w/ H&V CEILING MOUNTED UNITS**

A.	CONSTRUCTION COST	=	$57,400	
B.	SIOH COST	(5.5% of 1A) =	$3,157	
C.	DESIGN COST	(6.0% of 1A) =	$3,444	
D.	TOTAL COST	(1A +1B +1C) =	$64,001	
E.	SALVAGE VALUE OF EXISTING EQUIPMENT =		$0	
F.	PUBLIC UTILITY COMPANY REBATE =		$0	
G.	TOTAL INVESTMENT	(1D -1E -1F) =	------->	$64,001

2. ENERGY SAVINGS (+) OR COST (-):

DATE OF NISTR 85-3273-9 USED FOR DISCOUNT FACTORS: JAN '95

	ENERGY SOURCE	FUEL COST $/MBTU (1)	SAVINGS MBTU/YR (2)	ANNUAL $ SAVINGS (3)	DISCOUNT FACTOR (4)	DISCOUNTED SAVINGS (5)	
A.	ELECT.	$12.10	20	$236	15.88	$3,753	
B.	DIST	$0.00	0	$0	19.16	$0	
C.	NAT GAS	$4.12	148	$609	18.30	$11,141	
D.	COAL	$0.00	0	$0	16.62	$0	
E.	ELEC. DEMAND			$48	14.88	$720	
F.	TOTAL		167	$894		-------->	$15,614

3. NON-ENERGY SAVINGS (+) OR COST (-)

A. ANNUAL RECURRING (+/-)

1 ANNUAL MAINTENANCE	$0	14.88	$0
2	$0	14.88	$0
3	$0	14.88	$0
4 TOTAL ANNUAL DISC. SAVINGS (+) / COST	$0		$0

B. NON-RECURRING (+/-)

ITEM	SAVINGS (+) COST(-) (1)	YEAR OF OCCURRENCE (2)	DISCOUNT FACTOR (3) (TABLE A-2)	DISCOUNTED SAVINGS/COST (4)
a. BASELINE EQUIP. REPLACEMEN	$17,611	5	0.863	$15,198
b.				$0
c.				$0
d.				$0
e.				$0
f. TOTAL	$17,611			$15,198

C. TOTAL NON-ENERGY DISCOUNTED SAVINGS (+) OR COST (-) (3A4 + 3Bf4) = $15,198

4.	FIRST YEAR DOLLAR SAVINGS (+) / COSTS (-)	(2F3+3A4+(3Bf1/Economic Life))	$1,774
5.	SIMPLE PAYBACK (SPB) IN YEARS (MUST BE < 10 YEARS TO QUALIFY)	(1G/4) =	36.08
6.	TOTAL NET DISCOUNTED SAVINGS	(2F5 + 3C) =	$30,812
7.	DISCOUNTED SAVINGS-TO-INVESTMENT RATIO (SIR) (MUST HAVE SIR > 1.25 TO QUALIFY)	(6/1G) =	0.48

ENGINEER'S OPINION OF PROBABLE COST

PROJECT	Fort Riley Feasibility Study for HVAC Upgrade	**SHEET**	1 **OF** 1
ENGINEER	E M C Engineers, Inc.	**DATE PREPARED**	4-May-95
	Denver, CO	**ESTIMATOR**	C. Wohlert
		CHECKED BY	A. Niemeyer

Line No.	Item Refer Code	Item Description	Unit of Measure	MATERIAL COST Quantity	MATERIAL COST Unit Cost	MATERIAL COST Total	LABOR COST Crew/ Worker	LABOR COST Hours/ Unit	LABOR COST Total	TOTAL
1		**BUILDING 202**								
2		**PROPOSED SYSTEM MODIFICATIONS**								
3										
4		*NEW SYSTEMS INSTALLATION*								
5	STLPIP2.5	STEEL PIPE SCH. 40, 2.5" W/HANGERS	L.F.	210.0	$5.28	$1,109	Q-15	0.34	$1,384	$2,493
6	STLPIP1	STEEL PIPE SCH. 40, 1" W/HANGERS	L.F.	210.0	$2.10	$442	Q-1	0.151	$615	$1,056
7		FITTINGS, 5%				$78			$100	$177
8	INSLPIP1	1" FIBERGLASS PIPE INSULATION, 1" THCK	L.F.	210.0	$0.62	$130	Q-14	0.073	$282	$413
9	INSLPIP2.	2.5" FIBERGLASS PIPE INSULATION, 1.5" THCK	L.F.	210.0	$1.60	$336	Q-14	0.089	$344	$680
10	ELCND1	ELECTRICAL CONDUIT 1"	L.F.	150.0	$0.83	$125	1-ELEC	0.064	$201	$326
11	WIRE#6	COPPER WIRING #6	C.L.F.	1.5	$24.71	$37	1-ELEC	1.231	$39	$76
12	DUCT500	GAL. STEEL DUCTWORK, 2000 TO 5000 LB.	LB.	5140.0	$0.45	$2,291	Q-10	0.087	$8,688	$10,979
13	AHU6750	6,750 CFM AHU, HEATING ONLY	EA.	4.0	$4,129.88	$16,520	Q-5	52.5	$4,072	$20,591
14										
15										
16										
17										
18										
19										
20										
21		*EXISTING SYSTEMS DEMOLITION*								
22		UNIT HEATER DEMO	EA.	2.0			Q-6	10.9	$438	$438
23										
24										
25										
26										
27										
28										
29										
30										
31		**SUBTOTAL**				$21,067			$16,164	$37,230
32	OH	OVERHEAD			17%	$3,539			$2,715	$6,255
33	PRO	PROFIT			10%	$2,461			$1,888	$4,349
34	CONT	CONTINGENCY			20%	$5,413			$4,153	$9,567
35	**TOTAL COST**		-	-	-	$32,480	-	-	$24,920	$57,400

ENGINEER'S OPINION OF PROBABLE COST

PROJECT	Fort Riley Feasibility Study for HVAC Upgrade	**SHEET** 1 **OF** 1	
ENGINEER	E M C Engineers, Inc.	**DATE PREPARED**	4-May-95
	Denver, CO	**ESTIMATOR**	C. Wohlert
		CHECKED BY	A. Niemeyer

Line No.	Item Refer Code	Item Description	Unit of Measure	MATERIAL COST Quantity	MATERIAL COST Unit Cost	MATERIAL COST Total	LABOR COST Crew/ Worker	LABOR COST Hours/ Unit	LABOR COST Total	TOTAL
1		**BUILDING 202**								
2		**NON-RECURRING**								
3										
4		*BASELINE - EXISTING EQUIP. REPLACEMENT*								
5	STLPIP2.5	STEEL PIPE SCH. 40, 2.5" W/HANGERS	L.F.	30.0	$5.28	$158	Q-15	0.34	$198	$356
6	STLPIP1	STEEL PIPE SCH. 40, 1" W/HANGERS	L.F.	30.0	$2.10	$63	Q-1	0.151	$88	$151
7		FITTINGS, 5%				$11			$14	$25
8	INSLPIP1	1" FIBERGLASS PIPE INSULATION, 1" THCK	L.F.	30.0	$0.62	$19	Q-14	0.073	$40	$59
9	INSLPIP2.	2.5" FIBERGLASS PIPE INSULATION, 1.5" THCK	L.F.	30.0	$1.60	$48	Q-14	0.089	$49	$97
10	AHU6750	6,750 CFM AHU, HEATING ONLY	EA.	2.0	$4,129.88	$8,260	Q-5	52.5	$2,036	$10,296
11										
12										
13										
14										
15										
16										
17										
18										
19										
20										
21		*EXISTING SYSTEMS DEMOLITION*								
22		UNIT HEATER DEMO	EA.	2.0			Q-6	10.9	$438	$438
23										
24										
25										
26										
27										
28										
29										
30										
31		**SUBTOTAL**				$8,559			$2,864	$11,423
32	OH	OVERHEAD			17%	$1,438			$481	$1,919
33	PRO	PROFIT			10%	$1,000			$334	$1,334
34	CONT	CONTINGENCY			20%	$2,199			$736	$2,935
35	**TOTAL COST**		-	-	-	$13,196	-	-	$4,415	$17,611

ENGINEER'S OPINION OF PROBABLE COST

PROJECT	Fort Riley Feasibility Study for HVAC Upgrade	**SHEET** 1	**OF** 1
ENGINEER	E M C Engineers, Inc.	**DATE PREPARED**	4-Mar-95
	Denver, CO	**ESTIMATOR**	C. Wohlert
		CHECKED BY	A. Niemeyer

Line No.	Item Refer Code	Item Description	Unit of Measure	MATERIAL COST Quantity	MATERIAL COST Unit Cost	MATERIAL COST Total	LABOR COST Crew/ Worker	LABOR COST Hours/ Unit	LABOR COST Total	TOTAL
1		**BUILDING 202**								
2		***ANNUAL RECURRING***								
3		***ANNUAL MAINTENANCE COST - BASELINE***								
4										
5										
6										
7										
8										
9										
10										
11										
12										
13										
14										
15	**TOTAL ANNUAL MAINTENANCE COST - BASELINE**		-	-	-	$0	-	-	$0	$0
16										
17		***ANNUAL MAINTENANCE COST - NEW HVAC REPLACEMENT***								
18										
19										
20										
21										
22										
23										
24										
25										
26										
27										
28										
29	**TOTAL ANNUAL MAINTENANCE COST - BASELINE**		-	-	-	$0	-	-	$0	$0
30										
31										
32										
33										
34										
35	**TOTAL ANNUAL MAINTENANCE COST SAVINGS**		-	-	-	$0	-	-	$0	$0

DEMAND LIMITING ANALYSIS BUILDING 202

SUMMER PEAK (KW) = 27812	1993 JUL BILL 7/1-8/2 ACTUAL	1993 AUG BILL 8/2-9/1 ACTUAL	1993 SEP BILL 9/3-10/1 ACTUAL	1993 OCT BILL 10/1-11/1 ACTUAL	1993 NOV BILL 11/1-12/1 ACTUAL	1993 DEC BILL 12/1-1/3 ACTUAL	1993 JAN BILL 1/4-2/1 ACTUAL	1993 FEB BILL 2/1-3/1 ACTUAL	1993 MAR BILL 3/3-4/1 ACTUAL	1993 APR BILL 4/1-5/3 ACTUAL	1993 MAY BILL 5/3-6/1 ACTUAL	1993 JUN BILL 6/1-7/1 ACTUAL
BASE CASE												
CAPACITY (KW)	32472	34452	26136	20754	26400	22752	27108	25812	23310	21834	21996	30096
POWER FACTOR (%)	99.20%	99.10%	99.10%	99.90%	99.80%	99.70%	99.50%	99.60%	99.60%	99.80%	99.60%	98.80%
CAPACITY (KVA)	32734	34765	26373	20775	26453	22820	27244	25916	23404	21878	22084	30462
80% SUMMER PEAK (KVA)	27812	27812	27812	27812	27812	27812	27812	27812	27812	27812	27812	27812
CONTRACT MINIMUM (KVA)	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643
BILLING CAPACITY (KVA)	32734	34765	27812	27812	27812	27812	27812	27812	27812	27812	27812	30462
ACTUAL OR 80% PEAK	ACTUAL	ACTUAL	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	ACTUAL
200 KVA @ $4.45	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00
NEXT 400 @ $4.25	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00
REMAINING @ $4.05	$130,142.18	$138,367.78	$110,208.22	$110,208.22	$110,208.22	$110,208.22	$110,208.22	$110,208.22	$110,208.22	$110,208.22	$110,208.22	$120,939.23
SUB DISCOUNT $.20	($6,546.77)	($6,952.98)	($5,562.38)	($5,562.38)	($5,562.38)	($5,562.38)	($5,562.38)	($5,562.38)	($5,562.38)	($5,562.38)	($5,562.38)	($6,092.31)
CAPACITY CHARGE	$126,185.40	$134,004.80	$107,235.84	$107,235.84	$107,235.84	$107,235.84	$107,235.84	$107,235.84	$107,235.84	$107,235.84	$107,235.84	$117,436.92
TOTAL ENERGY (KWH)	16,920,000	16,200,000	10,980,000	10,140,000	11,160,000	12,930,000	12,600,000	12,270,000	12,480,000	11,070,000	9,720,000	13,170,000
50*KVA @ $.03924	$64,223.85	$68,208.70	$54,566.96	$54,566.96	$54,566.96	$54,566.96	$54,566.96	$54,566.96	$54,566.96	$54,566.96	$54,566.96	$59,765.54
100*KVA @ $.03404	$111,426.10	$118,339.66	$94,671.73	$94,671.73	$94,671.73	$94,671.73	$94,671.73	$94,671.73	$94,671.73	$94,671.73	$94,671.73	$103,691.08
250*KVA @ $.03084	$252,378.15	$268,037.26	$209,965.32	$184,059.72	$214,429.80	$214,429.80	$214,429.80	$214,429.80	$214,429.80	$212,740.92	$171,106.92	$234,858.46
EXCESS @ $.02864	$109,589.57	$65,701.49	$0.00	$0.00	$1,009.19	$51,701.99	$42,250.79	$32,799.59	$38,813.99	$0.00	$0.00	$28,221.42
ENERGY CHARGE	$537,617.67	$520,287.11	$359,204.01	$333,298.41	$364,677.69	$415,370.49	$405,919.29	$396,468.09	$402,482.49	$361,979.61	$320,345.61	$426,536.49
TOTAL CHARGE LESS ECA	$663,803.07	$654,291.92	$466,439.85	$440,534.25	$471,913.53	$522,606.33	$513,155.13	$503,703.93	$509,718.33	$469,215.45	$427,581.45	$543,973.42
DEMAND REDUCTION (KW)	**0.91**	**0.91**	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.91**
CAPACITY (KW)	32471	34451	26136	20754	26400	22752	27108	25812	23310	21834	21996	30095
POWER FACTOR (%)	99.20%	99.10%	99.10%	99.90%	99.80%	99.70%	99.50%	99.60%	99.60%	99.80%	99.60%	98.80%
CAPACITY (KVA)	32733	34764	26373	20775	26453	22820	27244	25916	23404	21878	22084	30461
80% SUMMER PEAK (KVA)	27811	27811	27811	27811	27811	27811	27811	27811	27811	27811	27811	27811
CONTRACT MINIMUM (KVA)	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643
BILLING CAPACITY (KVA)	32733	34764	27811	27811	27811	27811	27811	27811	27811	27811	27811	30461
ACTUAL OR 80% PEAK	ACTUAL	ACTUAL	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	ACTUAL
200 KVA @ $4.45	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00
NEXT 400 @ $4.25	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00
REMAINING @ $4.05	$130,138.48	$138,364.08	$110,205.26	$110,205.26	$110,205.26	$110,205.26	$110,205.26	$110,205.26	$110,205.26	$110,205.26	$110,205.26	$120,935.52
SUB DISCOUNT $.20	($6,546.59)	($6,952.79)	($5,562.24)	($5,562.24)	($5,562.24)	($5,562.24)	($5,562.24)	($5,562.24)	($5,562.24)	($5,562.24)	($5,562.24)	($6,092.12)
CAPACITY CHARGE	$126,181.89	$134,001.29	$107,233.03	$107,233.03	$107,233.03	$107,233.03	$107,233.03	$107,233.03	$107,233.03	$107,233.03	$107,233.03	$117,433.39
TOTAL ENERGY (KWH)	16,920,000	16,200,000	10,980,000	10,140,000	11,160,000	12,930,000	12,600,000	12,270,000	12,480,000	11,070,000	9,720,000	13,170,000
50*KVA @ $.03924	$64,222.06	$68,206.91	$54,565.53	$54,565.53	$54,565.53	$54,565.53	$54,565.53	$54,565.53	$54,565.53	$54,565.53	$54,565.53	$59,763.74
100*KVA @ $.03404	$111,422.99	$118,336.56	$94,669.24	$94,669.24	$94,669.24	$94,669.24	$94,669.24	$94,669.24	$94,669.24	$94,669.24	$94,669.24	$103,687.96
250*KVA @ $.03084	$252,371.11	$268,030.21	$209,968.70	$184,063.10	$214,424.17	$214,424.17	$214,424.17	$214,424.17	$214,424.17	$212,744.30	$171,110.30	$234,851.40
EXCESS @ $.02864	$109,600.03	$65,711.96	$0.00	$0.00	$1,017.56	$51,710.36	$42,259.16	$32,807.96	$38,822.36	$0.00	$0.00	$28,231.91
ENERGY CHARGE	$537,616.19	$520,285.63	$359,203.47	$333,297.87	$364,676.51	$415,369.31	$405,918.11	$396,466.91	$402,481.31	$361,979.07	$320,345.07	$426,535.01
TOTAL CHARGE LESS ECA	$663,798.08	$654,286.92	$466,436.50	$440,530.90	$471,909.53	$522,602.33	$513,151.13	$503,699.93	$509,714.33	$469,212.10	$427,578.10	$543,968.40
SUMMARY												
MONTHLY DIFFERENCE	$4.99	$5.00	$3.35	$3.35	$4.00	$4.00	$4.00	$4.00	$4.00	$3.35	$3.35	$5.01
ANNUAL DIFFERENCE.............		**$48.41**										

NUMBER OF EXTERIOR SURFACES 4 RECTANGULAR 4 OTHER 0
(U-VALUE INCLUDES INSIDE AIR FILM PLUS OUTSIDE AIR FILM AT 7.5 MPH WINDSPEED)

SURFACE	SPACE	GLASS U-VALUE (BTU/HR-SQFT-F)	GLASS AREA (SQFT)	WALL U-VALUE (BTU/HR-SQFT-F)	WALL AREA (SQFT)	WALL+GLASS U-VALUE (BTU/HR-SQFT-F)	WALL+GLASS AREA (SQFT)	AZIMUTH
	B-BALL-CT	0.000	0.00	0.037	2275.00	0.037	2275.00	EAST
	B-BALL-CT	0.000	0.00	0.037	3052.50	0.037	3052.50	SOUTH
	B-BALL-CT	0.490	60.00	0.037	2215.00	0.049	2275.00	WEST
	B-BALL-CT	0.000	0.00	0.062	10101.00	0.062	10101.00	ROOF
	B-BALL-CT	0.000	0.00	0.020	728.00	0.020	728.00	UNDERGRND
	B-BALL-CT	0.000	0.00	0.020	720.00	0.020	720.00	UNDERGRND
	B-BALL-CT	0.000	0.00	0.020	752.00	0.020	752.00	UNDERGRND
	B-BALL-CT	0.000	0.00	0.020	10101.00	0.020	10101.00	UNDERGRND

EMC ENGINEERS INC. EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/16/1995 11:22:41 LDL RUN 1
DENVER, CO 80227 EXISTING CONDITION OF BLDG 202 THE GYM AREA
REPORT- LV-D DETAILS OF EXTERIOR SURFACES IN THE PROJECT TOPEKA, KS

	AVERAGE U-VALUE/GLASS (BTU/HR-SQFT-F)	AVERAGE U-VALUE/WALLS (BTU/HR-SQFT-F)	AVERAGE U-VALUE WALLS+GLASS (BTU/HR-SQFT-F)	GLASS AREA (SQFT)	OPAQUE AREA (SQFT)	GLASS+OPAQUE AREA (SQFT)
EAST	0.000	0.037	0.037	0.00	2275.00	2275.00
SOUTH	0.000	0.037	0.037	0.00	3052.50	3052.50
WEST	0.490	0.037	0.049	60.00	2215.00	2275.00
ROOF	0.000	0.062	0.062	0.00	10101.00	10101.00
ALL WALLS	0.490	0.037	0.040	60.00	7542.50	7602.50
WALLS+ROOFS	0.490	0.051	0.053	60.00	17643.50	17703.50
UNDERGRND	0.000	0.020	0.020	0.00	12301.00	12301.00
BUILDING	0.490	0.038	0.039	60.00	29944.50	30004.50

*** BUILDING ***

FLOOR AREA	10101	SQFT	938	SQMT
VOLUME	333333	CUFT	9440	CUMT

	COOLING LOAD				HEATING LOAD	
TIME	AUG 24	5PM			JAN 16	8AM
DRY-BULB TEMP	95F	35C			14F	-10C
WET-BULB TEMP	77F	25C			11F	-12C

	SENSIBLE (KBTU/H)	SENSIBLE (KW)	LATENT (KBTU/H)	LATENT (KW)	SENSIBLE (KBTU/H)	SENSIBLE (KW)
WALLS	5.223	1.530	0.000	0.000	-19.411	-5.685
ROOFS	21.868	6.405	0.000	0.000	-41.434	-12.135
GLASS CONDUCTION	0.900	0.264	0.000	0.000	-1.986	-0.582
GLASS SOLAR	3.522	1.032	0.000	0.000	0.172	0.050
DOOR	0.000	0.000	0.000	0.000	0.000	0.000
INTERNAL SURFACES	0.000	0.000	0.000	0.000	0.000	0.000
UNDERGROUND SURFACES	-1.164	-0.341	0.000	0.000	-7.063	-2.069
OCCUPANTS TO SPACE	20.394	5.973	32.768	9.597	1.259	0.369
LIGHT TO SPACE	71.593	20.968	0.000	0.000	7.117	2.084
EQUIPMENT TO SPACE	0.000	0.000	0.000	0.000	0.000	0.000
PROCESS TO SPACE	0.000	0.000	0.000	0.000	0.000	0.000
INFILTRATION	14.607	4.278	21.851	6.400	-35.406	-10.370
TOTAL	136.944	40.107	54.619	15.997	-96.753	-28.336
TOTAL LOAD	191.563 KBTU/H		56.104 KW		-96.753 KBTU/H	-28.336 KW
TOTAL LOAD / AREA	18.96BTU/H.SQFT		59.786 W /SQMT		9.579BTU/H.SQFT	30.196 W /SQMT

NOTE 1) THE ABOVE LOADS EXCLUDE OUTSIDE VENTILATION AIR LOADS
2) TIMES GIVEN IN STANDARD TIME FOR THE LOCATION IN CONSIDERATION

EMC ENGINEERS INC. EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/16/1995 11:22:41 SDL RUN 1
DENVER, CO 80227 EXISTING CONDITION OF BLDG 202 THE GYM AREA
REPORT- SS-A SYSTEM MONTHLY LOADS SUMMARY FOR H&VSYSTEMS TOPEKA, KS

MONTH	COOLING ENERGY (MBTU)	COOLING TIME OF MAX DY	HR	DRY-BULB TEMP	WET-BULB TEMP	MAXIMUM COOLING LOAD (KBTU/HR)	HEATING ENERGY (MBTU)	HEATING TIME OF MAX DY	HR	DRY-BULB TEMP	WET-BULB TEMP	MAXIMUM HEATING LOAD (KBTU/HR)	ELEC-TRICAL ENERGY (KWH)	MAXIMUM ELEC LOAD (KW)
JAN	0.00000					0.000	-121.250	15	4	-8.F	-9.F	-519.665	12721.	28.294
FEB	0.00000					0.000	-77.889	3	7	-5.F	-6.F	-488.342	11213.	28.294
MAR	0.00000					0.000	-56.840	3	7	14.F	12.F	-377.592	12569.	28.294
APR	0.00000					0.000	-17.517	5	5	31.F	29.F	-257.194	12848.	28.294
MAY	0.00000					0.000	-4.446	5	7	44.F	40.F	-166.788	14067.	28.294
JUN	0.00000					0.000	0.000					0.000	14055.	28.294
JUL	0.00000					0.000	0.000					0.000	14426.	28.294
AUG	0.00000					0.000	0.000					0.000	14770.	28.294
SEP	0.00000					0.000	0.000					0.000	13908.	28.294
OCT	0.00000					0.000	-17.194	20	8	23.F	22.F	-294.129	13362.	28.294
NOV	0.00000					0.000	-42.088	3	6	13.F	12.F	-367.513	12273.	28.294
DEC	0.00000					0.000	-89.447	12	5	4.F	3.F	-441.779	12303.	28.294
TOTAL	0.000						-426.672						158522.	
MAX						0.000						-519.665		28.294

D9-9

EMC ENGINEERS INC. EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/16/1995 11:22:41 SDL RUN 1
DENVER, CO 80227 EXISTING CONDITION OF BLDG 202 THE GYM AREA
REPORT- SS-C SYSTEM MONTHLY LOAD HOURS FOR H&VSYSTEMS TOPEKA, KS

MONTH	HOURS COOLING LOAD	HOURS HEATING LOAD	HOURS COINCIDENT COOL-HEAT LOAD	HOURS FLOATING	HOURS HEATING AVAIL.	HOURS COOLING AVAIL.	HOURS FANS ON	HOURS FANS CYCLE ON	HOURS NIGHT VENTING	HOURS FLOATING WHEN FANS ON	COINCIDENT LOADS: HEATING LOAD AT COOLING PEAK (KBTU/HR)	COINCIDENT LOADS: ELECTRIC LOAD AT COOLING PEAK (KW)
JAN	0	405	0	339	744	0	405	405	0	0	-231.111	5.753
FEB	0	323	0	349	672	0	323	323	0	0	0.000	0.000
MAR	0	346	0	398	744	0	355	355	0	9	-235.639	5.753
APR	0	342	0	378	720	0	474	474	0	132	0.000	0.000
MAY	0	165	0	579	360	0	639	639	0	474	0.000	0.000
JUN	0	0	0	720	0	0	680	680	0	680	0.000	5.753
JUL	0	0	0	744	0	0	721	721	0	721	0.000	5.753
AUG	0	0	0	744	0	0	722	722	0	722	0.000	5.753
SEP	0	0	0	720	0	0	674	674	0	674	0.000	5.753
OCT	0	356	0	388	720	0	536	536	0	180	-168.544	5.753
NOV	0	332	0	388	720	0	378	378	0	46	0.000	0.000
DEC	0	348	0	396	744	0	348	348	0	0	-272.716	5.753
ANNUAL	0	2617	0	6143	5424	0	6255	6255	0	3638		

MO	UTILITY-	ELECTRICITY	NATURAL-GAS
	TOTAL(MBTU)	48.765	166.272
JAN	PEAK(KBTU)	109.979	653.981
	DY/HR	31/21	15/ 4
	TOTAL(MBTU)	42.478	111.178
FEB	PEAK(KBTU)	109.979	620.982
	DY/HR	28/22	3/ 7
	TOTAL(MBTU)	46.664	84.210
MAR	PEAK(KBTU)	109.979	501.325
	DY/HR	31/21	3/ 7
	TOTAL(MBTU)	45.905	29.320
APR	PEAK(KBTU)	109.979	365.966
	DY/HR	24/ 9	5/ 5
	TOTAL(MBTU)	48.778	8.196
MAY	PEAK(KBTU)	109.775	260.713
	DY/HR	9/ 7	5/ 7
	TOTAL(MBTU)	47.991	0.000
JUN	PEAK(KBTU)	96.606	0.000
	DY/HR	30/22	30/ 1
	TOTAL(MBTU)	49.258	0.000
JUL	PEAK(KBTU)	96.606	0.000
	DY/HR	31/20	31/ 1
	TOTAL(MBTU)	50.432	0.000
AUG	PEAK(KBTU)	96.606	0.000
	DY/HR	31/22	31/ 1
	TOTAL(MBTU)	47.488	0.000
SEP	PEAK(KBTU)	96.606	0.000
	DY/HR	30/22	30/ 1
	TOTAL(MBTU)	47.807	29.615
OCT	PEAK(KBTU)	109.979	408.076
	DY/HR	31/ 6	20/ 8
	TOTAL(MBTU)	45.100	64.216
NOV	PEAK(KBTU)	109.979	490.205
	DY/HR	30/22	3/ 6
	TOTAL(MBTU)	46.499	125.854
DEC	PEAK(KBTU)	109.979	571.241
	DY/HR	31/11	12/ 5
	ONE YEAR	567.166	618.861
	USE/PEAK	109.979	653.981

ENERGY TYPE IN SITE MBTU - CATEGORY OF USE	ELECTRICITY	NATURAL-GAS
SPACE HEAT	21.05	618.86
SPACE COOL	0.00	0.00
HVAC AUX	127.75	0.00
DOM HOT WTR	0.00	0.00
AUX SOLAR	0.00	0.00
LIGHTS	418.35	0.00
VERT TRANS	0.00	0.00
MISC EQUIP	0.00	0.00
TOTAL	567.15	618.86

TOTAL SITE ENERGY 1186.03 MBTU 54.3 KBTU/SQFT-YR GROSS-AREA 117.4 KBTU/SQFT-YR NET-AREA
TOTAL SOURCE ENERGY 2322.06 MBTU 106.2 KBTU/SQFT-YR GROSS-AREA 229.9 KBTU/SQFT-YR NET-AREA
PERCENT OF HOURS ANY SYSTEM ZONE OUTSIDE OF THROTTLING RANGE = 0.0
PERCENT OF HOURS ANY PLANT LOAD NOT SATISFIED = 0.0
NOTE ELECTRICITY AND/OR FUEL USED TO GENERATE ELECTRICITY IS APPORTIONED BASED ON THE YEARLY DEMAND. ALL OTHER ENERGY TYPES ARE APPORTIONED HOURLY.

EMC ENGINEERS INC. EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/16/1995 11:24:12 SDL RUN 1
DENVER, CO 80227 PROPOSED MODIFICATION OF BLDG 202 THE GYM AREA
REPORT- SS-A SYSTEM MONTHLY LOADS SUMMARY FOR H&VSYSTEMS TOPEKA, KS

	COOLING						HEATING						ELEC	
MONTH	COOLING ENERGY (MBTU)	TIME OF MAX DY	HR	DRY-BULB TEMP	WET-BULB TEMP	MAXIMUM COOLING LOAD (KBTU/HR)	HEATING ENERGY (MBTU)	TIME OF MAX DY	HR	DRY-BULB TEMP	WET-BULB TEMP	MAXIMUM HEATING LOAD (KBTU/HR)	ELEC-TRICAL ENERGY (KWH)	MAXIMUM ELEC LOAD (KW)
JAN	0.00000					0.000	-95.741	15	6	-8.F	-9.F	-490.946	12226.	27.526
FEB	0.00000					0.000	-60.913	3	7	-5.F	-6.F	-460.894	10890.	27.526
MAR	0.00000					0.000	-45.885	3	7	14.F	12.F	-347.743	12471.	27.526
APR	0.00000					0.000	-12.606	5	5	31.F	29.F	-219.333	12893.	27.526
MAY	0.00000					0.000	-3.540	1	5	38.F	37.F	-136.802	13737.	27.526
JUN	0.00000					0.000	0.000					0.000	13524.	27.526
JUL	0.00000					0.000	0.000					0.000	13868.	27.526
AUG	0.00000					0.000	0.000					0.000	14221.	27.526
SEP	0.00000					0.000	0.000					0.000	13391.	27.526
OCT	0.00000					0.000	-13.593	20	7	23.F	23.F	-263.341	13340.	27.526
NOV	0.00000					0.000	-31.408	3	6	13.F	12.F	-334.676	12157.	27.526
DEC	0.00000					0.000	-70.635	15	2	3.F	2.F	-416.943	11971.	27.526
TOTAL	0.000						-334.321						154686.	
MAX						0.000						-490.946		27.526

EMC ENGINEERS INC. EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/16/1995 11:24:12 SDL RUN 1
DENVER, CO 80227 PROPOSED MODIFICATION OF BLDG 202 THE GYM AREA
REPORT- SS-C SYSTEM MONTHLY LOAD HOURS FOR H&VSYSTEMS TOPEKA, KS

	NUMBER OF HOURS										COINCIDENT LOADS	
MONTH	HOURS COOLING LOAD	HOURS HEATING LOAD	HOURS COINCIDENT COOL-HEAT LOAD	HOURS FLOATING	HOURS HEATING AVAIL.	HOURS COOLING AVAIL.	HOURS FANS ON	HOURS FANS CYCLE ON	HOURS NIGHT VENTING	HOURS FLOATING WHEN FANS ON	HEATING LOAD AT COOLING PEAK (KBTU/HR)	ELECTRIC LOAD AT COOLING PEAK (KW)
JAN	0	368	0	376	744	0	368	368	0	0	0.000	0.000
FEB	0	308	0	364	672	0	308	308	0	0	-207.612	4.986
MAR	0	362	0	382	744	0	390	390	0	28	-206.014	4.986
APR	0	362	0	358	720	0	556	556	0	194	-67.109	4.986
MAY	0	174	0	570	360	0	671	671	0	497	0.000	0.000
JUN	0	0	0	720	0	0	678	678	0	678	0.000	4.986
JUL	0	0	0	744	0	0	720	720	0	720	0.000	4.986
AUG	0	0	0	744	0	0	723	723	0	723	0.000	4.986
SEP	0	0	0	720	0	0	674	674	0	674	0.000	4.986
OCT	0	390	0	354	720	0	614	614	0	224	-137.293	4.986
NOV	0	345	0	375	720	0	413	413	0	68	-240.486	4.986
DEC	0	335	0	409	744	0	335	335	0	0	-239.171	4.986
ANNUAL	0	2644	0	6116	5424	0	6450	6450	0	3806		

MO	UTILITY-	ELECTRICITY	NATURAL-GAS
	TOTAL(MBTU)	46.187	132.381
JAN	PEAK(KBTU)	106.621	617.840
	DY/HR	31/22	15/ 6
	TOTAL(MBTU)	40.813	88.615
FEB	PEAK(KBTU)	106.621	586.177
	DY/HR	28/21	3/ 7
	TOTAL(MBTU)	45.909	69.242
MAR	PEAK(KBTU)	106.621	463.711
	DY/HR	31/21	3/ 7
	TOTAL(MBTU)	45.775	22.061
APR	PEAK(KBTU)	106.621	318.504
	DY/HR	15/ 8	5/ 5
	TOTAL(MBTU)	47.571	6.724
MAY	PEAK(KBTU)	103.363	221.684
	DY/HR	9/ 7	1/ 5
	TOTAL(MBTU)	46.176	0.000
JUN	PEAK(KBTU)	93.987	0.000
	DY/HR	30/22	30/ 1
	TOTAL(MBTU)	47.353	0.000
JUL	PEAK(KBTU)	93.987	0.000
	DY/HR	31/20	31/ 1
	TOTAL(MBTU)	48.558	0.000
AUG	PEAK(KBTU)	93.987	0.000
	DY/HR	31/22	31/ 1
	TOTAL(MBTU)	45.723	0.000
SEP	PEAK(KBTU)	93.987	0.000
	DY/HR	30/22	30/ 1
	TOTAL(MBTU)	47.506	24.133
OCT	PEAK(KBTU)	106.621	369.014
	DY/HR	31/ 6	20/ 7
	TOTAL(MBTU)	44.249	49.359
NOV	PEAK(KBTU)	106.621	449.238
	DY/HR	30/21	3/ 6
	TOTAL(MBTU)	44.779	101.105
DEC	PEAK(KBTU)	106.621	539.218
	DY/HR	31/19	15/ 2
	ONE YEAR	550.598	493.620
	USE/PEAK	106.621	617.840

ENERGY TYPE IN SITE MBTU - CATEGORY OF USE	ELECTRICITY	NATURAL-GAS
SPACE HEAT	17.77	493.62
SPACE COOL	0.00	0.00
HVAC AUX	114.47	0.00
DOM HOT WTR	0.00	0.00
AUX SOLAR	0.00	0.00
LIGHTS	418.37	0.00
VERT TRANS	0.00	0.00
MISC EQUIP	0.00	0.00
TOTAL	550.60	493.62

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TOTAL SITE ENERGY      1044.22 MBTU     47.8 KBTU/SQFT-YR GROSS-AREA    103.4 KBTU/SQFT-YR NET-AREA
TOTAL SOURCE ENERGY    2147.07 MBTU     98.2 KBTU/SQFT-YR GROSS-AREA    212.6 KBTU/SQFT-YR NET-AREA
PERCENT OF HOURS ANY SYSTEM ZONE OUTSIDE OF THROTTLING RANGE =  0.1
PERCENT OF HOURS ANY PLANT LOAD NOT SATISFIED                =  0.0
NOTE  ELECTRICITY AND/OR FUEL USED TO GENERATE ELECTRICITY IS APPORTIONED BASED
      ON THE YEARLY DEMAND.  ALL OTHER ENERGY TYPES ARE APPORTIONED HOURLY.
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BUILDING 7485
ANNUAL ENERGY SAVINGS SUMMARY

Item	Baseline	ECO	Annual Energy Savings	Adj. Annual Energy Savings*
Annual Electric (MBTU)	2233.59	1745.40	488.19	488.19
Annual Natural Gas (MBTU)	1218.76	1511.28	-292.52	-292.52
Electric Demand June (KW)	138.43	121.10	17.33	17.33
Electric Demand July (KW)	149.33	133.81	15.52	15.52
Electric Demand August (KW)	146.43	130.68	15.75	15.75

*Energy savings prorated on a square foot basis:

Baseline Model Bldg 7485 (sq.ft.)	35216
ECO Model Bldg 7485 (sq.ft.)	35216
Square Footage Adjustment Factor	1.000

LIFE CYCLE COST ANALYSIS SUMMARY
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

LOCATION:	Fort Riley	REGION: 2 (Kansas)		PROJECT NO:	1406-005
PROJECT TITLE:	Feasibility Study for HVAC Upgrade			FISCAL YEAR:	1995
ANALYSIS DATE:	05/08/95	ECONOMIC LIFE:	20	PREPARED BY:	C. Wohlert

1. INVESTMENT: **BLDG 7485 - Convert DD AHUs to DDs with VAV Units**

A.	CONSTRUCTION COST	=	$13,502	
B.	SIOH COST	(5.5% of 1A) =	$743	
C.	DESIGN COST	(6.0% of 1A) =	$810	
D.	TOTAL COST	(1A +1B +1C) =	$15,055	
E.	SALVAGE VALUE OF EXISTING EQUIPMENT =		$0	
F.	PUBLIC UTILITY COMPANY REBATE =		$0	
G.	TOTAL INVESTMENT	(1D -1E -1F) =	------->	$15,055

2. ENERGY SAVINGS (+) OR COST (-):

DATE OF NISTR 85-3273-9 USED FOR DISCOUNT FACTORS: JAN '95

	ENERGY SOURCE	FUEL COST $/MBTU (1)	SAVINGS MBTU/YR (2)	ANNUAL $ SAVINGS (3)	DISCOUNT FACTOR (4)	DISCOUNTED SAVINGS (5)	
A.	ELECT.	$12.10	488	$5,907	15.88	$93,805	
B.	DIST	$0.00	0	$0	19.16	$0	
C.	NAT GAS	$4.12	(293)	($1,205)	18.30	($22,055)	
D.	COAL	$0.00	0	$0	16.62	$0	
E.	ELEC. DEMAND			$850	14.88	$12,642	
F.	TOTAL		196	$5,552		-------->	$84,392

3. NON-ENERGY SAVINGS (+) OR COST (-)

A. ANNUAL RECURRING (+/-)

1 ANNUAL MAINTENANCE	$0	14.88	$0
2	$0	14.88	$0
3	$0	14.88	$0
4 TOTAL ANNUAL DISC. SAVINGS (+) / COST (	$0		$0

B. NON-RECURRING (+/-)

ITEM	SAVINGS (+) COST(-) (1)	YEAR OF OCCURRENCE (2)	DISCOUNT FACTOR (3) (TABLE A-2)	DISCOUNTED SAVINGS/COST (4)
a. BASELINE EQUIP. REPLCMNT.	$0	5	0.863	$0
b.				$0
c.				$0
d.				$0
e.				$0
f. TOTAL	$0			$0

C. TOTAL NON-ENERGY DISCOUNTED SAVINGS (+) OR COST (-) (3A4 + 3Bf4) = $0

4.	FIRST YEAR DOLLAR SAVINGS (+) / COSTS (-)	(2F3+3A4+(3Bf1/Economic Life))	$5,552
5.	SIMPLE PAYBACK (SPB) IN YEARS (MUST BE < 10 YEARS TO QUALIFY)	(1G/4) =	2.71
6.	TOTAL NET DISCOUNTED SAVINGS	(2F5 + 3C) =	$84,392
7.	DISCOUNTED SAVINGS-TO-INVESTMENT RATIO (SIR) (MUST HAVE SIR > 1.25 TO QUALIFY)	(6/1G) =	5.61

ENGINEER'S OPINION OF PROBABLE COST

PROJECT	Fort Riley Feasibility Study for HVAC Upgrade	**SHEET** 1 **OF** 1	
		DATE PREPARED	8-May-95
ENGINEER	E M C Engineers, Inc.	**ESTIMATOR**	C. Wohlert
	Denver, CO	**CHECKED BY**	A. Niemeyer

Line No.	Item Refer Code	Item Description	Unit of Measure	MATERIAL COST Quantity	MATERIAL COST Unit Cost	MATERIAL COST Total	LABOR COST Crew/ Worker	LABOR COST Hours/ Unit	LABOR COST Total	TOTAL
1		**BUILDING 7485**								
2		**PROPOSED SYSTEM MODIFICATIONS**								
3										
4	VSD20	VARIABLE SPEED DRIVE W/ CONTRLER,20HP	EA.	1	$4,844.03	$4,844	1-ELEC	19	$398	$5,242
5	E-TSTAT1	SINGLE SETPOINT ELEC. TSTAT, 3 WIRE	EA.	12	$24.23	$291	1-ELEC	0.8	$201	$492
6	WIRE#12	COPPER WIRING #12	C.L.F.	8	$7.41	$62	1-ELEC	0.727	$128	$190
7	VAVBX8	VAV BOX, 800 CFM, ELEC	EA.	19	$331.40	$6,297	1-SHEE	1.5	$593	$6,890
8										
9										
10										
11										
12										
13										
14										
15										
16										
17										
18										
19										
20										
21										
22										
23										
24										
25		*EXISTING SYSTEMS DEMOLITION*								
26		DUAL DUCT MIXING BOX DEMO	EA.	19.0			1-SHEE	3	$1,186	$1,186
27										
28										
29										
30										
31		**SUBTOTAL**				$6,650			$2,108	$8,758
32	OH	OVERHEAD			17%	$1,117			$354	$1,471
33	PRO	PROFIT			10%	$777			$246	$1,023
34	CONT	CONTINGENCY			20%	$1,709			$542	$2,250
35	**TOTAL COST**		-	-	-	$10,252	-	-	$3,250	$13,502

ENGINEER'S OPINION OF PROBABLE COST

PROJECT	Fort Riley Feasibility Study for HVAC Upgrade	**SHEET**	1 OF 1
		DATE PREPARED	1-Mar-95
ENGINEER	E M C Engineers, Inc.	**ESTIMATOR**	C. Wohlert
	Denver, CO	**CHECKED BY**	A. Niemeyer

Line No.	Item Refer Code	Item Description	Unit of Measure	MATERIAL COST Quantity	MATERIAL COST Unit Cost	MATERIAL COST Total	LABOR COST Crew/ Worker	LABOR COST Hours/ Unit	LABOR COST Total	TOTAL
1		**BUILDING 7485**								
2		**NON-RECURRING**								
3										
4										
5										
6										
7										
8										
9										
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24										
25										
26										
27										
28										
29										
30										
31		**SUBTOTAL**				$0			$0	$0
32	OH	OVERHEAD			17%	$0			$0	$0
33	PRO	PROFIT			10%	$0			$0	$0
34	CONT	CONTINGENCY			20%	$0			$0	$0
35	**TOTAL COST**		-	-	-	$0	-	-	$0	$0

ENGINEER'S OPINION OF PROBABLE COST

PROJECT	Fort Riley Feasibility Study for HVAC Upgrade	**SHEET** 1 **OF** 1	
		DATE PREPARED	1-Mar-95
ENGINEER	E M C Engineers, Inc.	**ESTIMATOR**	C. Wohlert
	Denver, CO	**CHECKED BY**	A. Niemeyer

Line No.	Item Refer Code	Item Description	Unit of Measure	MATERIAL COST Quantity	MATERIAL COST Unit Cost	MATERIAL COST Total	LABOR COST Crew/ Worker	LABOR COST Hours/ Unit	LABOR COST Total	TOTAL
1		**BUILDING 7485**								
2		***ANNUAL RECURRING***								
3		***ANNUAL MAINTENANCE COST - BASELINE***								
4										
5										
6										
7										
8										
9										
10										
11										
12										
13										
14										
15	**TOTAL ANNUAL MAINTENANCE COST - BASELINE**		-	-	-	$0	-	-	$0	$0
16										
17		***ANNUAL MAINTENANCE COST - NEW HVAC REPLACEMENT***								
18										
19										
20										
21										
22										
23										
24										
25										
26										
27										
28										
29	**TOTAL ANNUAL MAINTENANCE COST - BASELINE**		-	-	-	$0	-	-	$0	$0
30										
31										
32										
33										
34										
35	**TOTAL ANNUAL MAINTENANCE COST SAVINGS**		-	-	-	$0	-	-	$0	$0

DEMAND LIMITING ANALYSIS BUILDING 7485

SUMMER PEAK (KW) = 27812	1993 JUL BILL 7/1-8/2 ACTUAL	1993 AUG BILL 8/2-9/1 ACTUAL	1993 SEP BILL 9/3-10/1 ACTUAL	1993 OCT BILL 10/1-11/1 ACTUAL	1993 NOV BILL 11/1-12/1 ACTUAL	1993 DEC BILL 12/1-1/3 ACTUAL	1993 JAN BILL 1/4-2/1 ACTUAL	1993 FEB BILL 2/1-3/1 ACTUAL	1993 MAR BILL 3/3-4/1 ACTUAL	1993 APR BILL 4/1-5/3 ACTUAL	1993 MAY BILL 5/3-6/1 ACTUAL	1993 JUN BILL 6/1-7/1 ACTUAL
BASE CASE												
CAPACITY (KW)	32472	34452	26136	20754	26400	22752	27108	25812	23310	21834	21996	30096
POWER FACTOR (%)	99.20%	99.10%	99.10%	99.90%	99.80%	99.70%	99.50%	99.60%	99.60%	99.80%	99.60%	98.80%
CAPACITY (KVA)	32734	34765	26373	20775	26453	22820	27244	25916	23404	21878	22084	30462
80% SUMMER PEAK (KVA)	27812	27812	27812	27812	27812	27812	27812	27812	27812	27812	27812	27812
CONTRACT MINIMUM (KVA)	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643
BILLING CAPACITY (KVA)	32734	34765	27812	27812	27812	27812	27812	27812	27812	27812	27812	30462
ACTUAL OR 80% PEAK	ACTUAL	ACTUAL	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	ACTUAL
200 KVA @ $4.45	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00
NEXT 400 @ $4.25	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00
REMAINING @ $4.05	$130,142.18	$138,367.78	$110,208.22	$110,208.22	$110,208.22	$110,208.22	$110,208.22	$110,208.22	$110,208.22	$110,208.22	$110,208.22	$120,939.23
SUB DISCOUNT $.20	($6,546.77)	($6,952.98)	($5,562.38)	($5,562.38)	($5,562.38)	($5,562.38)	($5,562.38)	($5,562.38)	($5,562.38)	($5,562.38)	($5,562.38)	($6,092.31)
CAPACITY CHARGE	$126,185.40	$134,004.80	$107,235.84	$107,235.84	$107,235.84	$107,235.84	$107,235.84	$107,235.84	$107,235.84	$107,235.84	$107,235.84	$117,436.92
TOTAL ENERGY (KWH)	16,920,000	16,200,000	10,980,000	10,140,000	11,160,000	12,930,000	12,600,000	12,270,000	12,480,000	11,070,000	9,720,000	13,170,000
50*KVA @ $.03924	$64,223.85	$68,208.70	$54,566.96	$54,566.96	$54,566.96	$54,566.96	$54,566.96	$54,566.96	$54,566.96	$54,566.96	$54,566.96	$59,765.54
100*KVA @ $.03404	$111,426.10	$118,339.66	$94,671.73	$94,671.73	$94,671.73	$94,671.73	$94,671.73	$94,671.73	$94,671.73	$94,671.73	$94,671.73	$103,691.08
250*KVA @ $.03084	$252,378.15	$268,037.26	$209,965.32	$184,059.72	$214,429.80	$214,429.80	$214,429.80	$214,429.80	$214,429.80	$212,740.92	$171,106.92	$234,858.46
EXCESS @ $.02864	$109,589.57	$65,701.49	$0.00	$0.00	$1,009.19	$51,701.99	$42,250.79	$32,799.59	$38,813.99	$0.00	$0.00	$28,221.42
ENERGY CHARGE	$537,617.67	$520,287.11	$359,204.01	$333,298.41	$364,677.69	$415,370.49	$405,919.29	$396,468.09	$402,482.49	$361,979.61	$320,345.61	$426,536.49
TOTAL CHARGE LESS ECA	$663,803.07	$654,291.92	$466,439.85	$440,534.25	$471,913.53	$522,606.33	$513,155.13	$503,703.93	$509,718.33	$469,215.45	$427,581.45	$543,973.42
DEMAND REDUCTION (KW)	**15.52**	**15.75**	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**17.33**
CAPACITY (KW)	32456	34436	26136	20754	26400	22752	27108	25812	23310	21834	21996	30079
POWER FACTOR (%)	99.20%	99.10%	99.10%	99.90%	99.80%	99.70%	99.50%	99.60%	99.60%	99.80%	99.60%	98.80%
CAPACITY (KVA)	32718	34749	26373	20775	26453	22820	27244	25916	23404	21878	22084	30444
80% SUMMER PEAK (KVA)	27799	27799	27799	27799	27799	27799	27799	27799	27799	27799	27799	27799
CONTRACT MINIMUM (KVA)	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643
BILLING CAPACITY (KVA)	32718	34749	27799	27799	27799	27799	27799	27799	27799	27799	27799	30444
ACTUAL OR 80% PEAK	ACTUAL	ACTUAL	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	ACTUAL
200 KVA @ $4.45	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00
NEXT 400 @ $4.25	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00
REMAINING @ $4.05	$130,078.81	$138,303.42	$110,156.73	$110,156.73	$110,156.73	$110,156.73	$110,156.73	$110,156.73	$110,156.73	$110,156.73	$110,156.73	$120,868.19
SUB DISCOUNT $.20	($6,543.64)	($6,949.80)	($5,559.84)	($5,559.84)	($5,559.84)	($5,559.84)	($5,559.84)	($5,559.84)	($5,559.84)	($5,559.84)	($5,559.84)	($6,088.80)
CAPACITY CHARGE	$126,125.16	$133,943.62	$107,186.89	$107,186.89	$107,186.89	$107,186.89	$107,186.89	$107,186.89	$107,186.89	$107,186.89	$107,186.89	$117,369.39
TOTAL ENERGY (KWH)	16,920,000	16,200,000	10,980,000	10,140,000	11,160,000	12,930,000	12,600,000	12,270,000	12,480,000	11,070,000	9,720,000	13,170,000
50*KVA @ $.03924	$64,193.15	$68,177.52	$54,542.02	$54,542.02	$54,542.02	$54,542.02	$54,542.02	$54,542.02	$54,542.02	$54,542.02	$54,542.02	$59,731.12
100*KVA @ $.03404	$111,372.83	$118,285.57	$94,628.45	$94,628.45	$94,628.45	$94,628.45	$94,628.45	$94,628.45	$94,628.45	$94,628.45	$94,628.45	$103,631.37
250*KVA @ $.03084	$252,257.50	$267,914.72	$210,024.13	$184,118.53	$214,331.78	$214,331.78	$214,331.78	$214,331.78	$214,331.78	$212,799.73	$171,165.73	$234,723.22
EXCESS @ $.02864	$109,768.83	$65,883.55	$0.00	$0.00	$1,154.84	$51,847.64	$42,396.44	$32,945.24	$38,959.64	$0.00	$0.00	$28,422.37
ENERGY CHARGE	$537,592.32	$520,261.37	$359,194.60	$333,289.00	$364,657.09	$415,349.89	$405,898.69	$396,447.49	$402,461.89	$361,970.20	$320,336.20	$426,508.07
TOTAL CHARGE LESS ECA	$663,717.48	$654,204.98	$466,381.50	$440,475.90	$471,843.99	$522,536.79	$513,085.59	$503,634.39	$509,648.79	$469,157.10	$427,523.10	$543,877.46
SUMMARY												
MONTHLY DIFFERENCE	$85.59	$86.93	$58.36	$58.36	$69.55	$69.55	$69.55	$69.55	$69.55	$58.36	$58.36	$95.95
ANNUAL DIFFERENCE..............		**$849.63**										

NUMBER OF EXTERIOR SURFACES 23 RECTANGULAR 23 OTHER 0
(U-VALUE INCLUDES INSIDE AIR FILM PLUS OUTSIDE AIR FILM AT 7.5 MPH WINDSPEED)

SURFACE	SPACE	GLASS U-VALUE (BTU/HR-SQFT-F)	GLASS AREA (SQFT)	WALL U-VALUE (BTU/HR-SQFT-F)	WALL AREA (SQFT)	WALL+GLASS U-VALUE (BTU/HR-SQFT-F)	WALL+GLASS AREA (SQFT)	AZIMUTH
	N_OLD_SPAC	0.000	0.00	0.236	3102.00	0.236	3102.00	NORTH
	N_NEW_SPAC	0.000	0.00	0.060	2332.00	0.060	2332.00	NORTH
	N_NEW_SPAC	0.000	0.00	0.060	660.00	0.060	660.00	EAST
	S_NEW_SPAC	0.000	0.00	0.060	660.00	0.060	660.00	EAST
	E_NEW_SPAC	0.000	0.00	0.060	2024.00	0.060	2024.00	EAST
	E_NEW_SPAC	0.000	0.00	0.236	2024.00	0.236	2024.00	EAST
	S_NEW_SPAC	1.021	167.62	0.060	1592.38	0.151	1760.00	SOUTH
	S_OLD_SPAC	1.021	174.24	0.236	2355.76	0.290	2530.00	SOUTH
	W_OLD_SPAC	0.000	0.00	0.236	2068.00	0.236	2068.00	WEST
	S_OLD_SPAC	0.000	0.00	0.236	660.00	0.236	660.00	WEST
	N_NEW_SPAC	0.000	0.00	0.060	198.00	0.060	198.00	WEST
	N_OLD_SPAC	0.000	0.00	0.236	352.00	0.236	352.00	WEST
	N_NEW_SPAC	0.000	0.00	0.028	3180.00	0.028	3180.00	ROOF
	CR_NEW_SPC	0.000	0.00	0.074	7728.00	0.074	7728.00	ROOF
	CR_NEW_SPC	0.000	0.00	0.028	7728.00	0.028	7728.00	ROOF
	S_NEW_SPAC	0.000	0.00	0.074	2520.00	0.074	2520.00	ROOF
	S_NEW_SPAC	0.000	0.00	0.028	2712.00	0.028	2712.00	ROOF
	W_OLD_SPAC	0.000	0.00	0.074	1504.00	0.074	1504.00	ROOF
	CR_OLD_SPA	0.000	0.00	0.074	11750.00	0.074	11750.00	ROOF
	S_OLD_SPAC	0.000	0.00	0.074	3765.00	0.074	3765.00	ROOF
	E_NEW_SPAC	0.000	0.00	0.028	2024.00	0.028	2024.00	ROOF
	E_NEW_SPAC	0.000	0.00	0.074	2024.00	0.074	2024.00	ROOF

	N_OLD_SPAC	0.000	0.00	0.074	2256.00	0.074	2256.00	ROOF
	N_OLD_SPAC	0.000	0.00	0.020	2256.00	0.020	2256.00	UNDERGRND
	CR_OLD_SPA	0.000	0.00	0.020	11750.00	0.020	11750.00	UNDERGRND
	S_OLD_SPAC	0.000	0.00	0.020	3765.00	0.020	3765.00	UNDERGRND
	W_OLD_SPAC	0.000	0.00	0.020	1504.00	0.020	1504.00	UNDERGRND
	N_NEW_SPAC	0.000	0.00	0.020	3180.00	0.020	3180.00	UNDERGRND
	CR_NEW·SPC	0.000	0.00	0.020	7728.00	0.020	7728.00	UNDERGRND
	CR_NEW_SPC	0.000	0.00	0.020	7728.00	0.020	7728.00	UNDERGRND
	CR_NEW_SPC	0.000	0.00	0.020	7728.00	0.020	7728.00	UNDERGRND
	S_NEW_SPAC	0.000	0.00	0.020	2520.00	0.020	2520.00	UNDERGRND
	S_NEW_SPAC	0.000	0.00	0.020	2712.00	0.020	2712.00	UNDERGRND
	E_NEW_SPAC	0.000	0.00	0.020	2024.00	0.020	2024.00	UNDERGRND

	AVERAGE U-VALUE/GLASS (BTU/HR-SQFT-F)	AVERAGE U-VALUE/WALLS (BTU/HR-SQFT-F)	AVERAGE U-VALUE WALLS+GLASS (BTU/HR-SQFT-F)	GLASS AREA (SQFT)	OPAQUE AREA (SQFT)	GLASS+OPAQUE AREA (SQFT)
NORTH	0.000	0.160	0.160	0.00	5434.00	5434.00
EAST	0.000	0.126	0.126	0.00	5368.00	5368.00
SOUTH	1.021	0.165	0.233	341.86	3948.14	4290.00
WEST	0.000	0.225	0.225	0.00	3278.00	3278.00
ROOF	0.000	0.059	0.059	0.00	47191.00	47191.00
ALL WALLS	1.021	0.163	0.179	341.86	18028.14	18370.00
WALLS+ROOFS	1.021	0.088	0.092	341.86	65219.14	65561.00
UNDERGRND	0.000	0.020	0.020	0.00	52895.00	52895.00
BUILDING	1.021	0.057	0.060	341.86	118114.14	118456.00

*** BUILDING ***

FLOOR AREA	34916	SQFT	3244	SQMT
VOLUME	768152	CUFT	21754	CUMT

	COOLING LOAD				HEATING LOAD	
TIME	JUL 23	8PM			JAN 15	7AM
DRY-BULB TEMP	91F	33C			-7F	-22C
WET-BULB TEMP	77F	25C			-8F	-22C
	SENSIBLE		LATENT		SENSIBLE	
	(KBTU/H)	(KW)	(KBTU/H)	(KW)	(KBTU/H)	(KW)
WALLS	57.468	16.831	0.000	0.000	-224.260	-65.680
ROOFS	104.978	30.745	0.000	0.000	-237.339	-69.511
GLASS CONDUCTION	5.365	1.571	0.000	0.000	-24.792	-7.261
GLASS SOLAR	19.927	5.836	0.000	0.000	0.878	0.257
DOOR	0.188	0.055	0.000	0.000	-0.747	-0.219
INTERNAL SURFACES	0.000	0.000	0.000	0.000	0.000	0.000
UNDERGROUND SURFACES	-9.497	-2.781	0.000	0.000	-30.373	-8.896
OCCUPANTS TO SPACE	96.973	28.401	177.967	52.122	11.021	3.228
LIGHT TO SPACE	130.067	38.093	0.000	0.000	33.017	9.670
EQUIPMENT TO SPACE	27.077	7.930	0.000	0.000	4.071	1.192
PROCESS TO SPACE	0.000	0.000	0.000	0.000	0.000	0.000
INFILTRATION	2.439	0.714	5.016	1.469	-1.246	-0.365
TOTAL	434.985	127.396	182.983	53.591	-469.771	-137.584
TOTAL LOAD	617.968 KBTU/H		180.987	KW	-469.771 KBTU/H	-137.584 KW
TOTAL LOAD / AREA	17.70BTU/H.SQFT		55.795	W /SQMT	13.454BTU/H.SQFT	42.414 W /SQMT

NOTE
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1) THE ABOVE LOADS EXCLUDE OUTSIDE VENTILATION AIR LOADS
2) TIMES GIVEN IN STANDARD TIME FOR THE LOCATION IN CONSIDERATION

EMC ENGINEERS INC. EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/28/1995 16:54:59 SDL RUN 1
DENVER, CO 80227 EXISTING CONDITION OF BLDG. 7485 BOWLING ALLEY
REPORT- SS-A SYSTEM MONTHLY LOADS SUMMARY FOR OLD_SYSTEM TOPEKA, KS

MONTH	COOLING: COOLING ENERGY (MBTU)	COOLING: TIME OF MAX DY	COOLING: TIME OF MAX HR	COOLING: DRY-BULB TEMP	COOLING: WET-BULB TEMP	COOLING: MAXIMUM COOLING LOAD (KBTU/HR)	HEATING: HEATING ENERGY (MBTU)	HEATING: TIME OF MAX DY	HEATING: TIME OF MAX HR	HEATING: DRY-BULB TEMP	HEATING: WET-BULB TEMP	HEATING: MAXIMUM HEATING LOAD (KBTU/HR)	ELEC: ELEC-TRICAL ENERGY (KWH)	ELEC: MAXIMUM ELEC LOAD (KW)
JAN	0.00000					0.000	-101.104	15	7	-7.F	-8.F	-341.887	25782.	45.178
FEB	0.00000					0.000	-70.502	3	7	-5.F	-6.F	-307.841	23218.	45.178
MAR	0.00000					0.000	-46.658	3	7	14.F	12.F	-231.875	25857.	45.178
APR	0.00000					0.000	-7.249	5	7	30.F	27.F	-130.964	25125.	45.178
MAY	69.04465	16	2	62.F	59.F	459.571	-0.642	1	2	44.F	41.F	-13.237	25601.	45.178
JUN	154.16762	24	20	83.F	74.F	381.421	0.000					0.000	25020.	45.178
JUL	191.51065	17	19	88.F	80.F	435.646	0.000					0.000	25707.	45.178
AUG	184.86569	20	21	87.F	75.F	405.733	0.000					0.000	25857.	45.178
SEP	119.15224	5	18	90.F	77.F	370.932	0.000					0.000	24945.	45.178
OCT	3.05387	1	18	83.F	68.F	247.028	-4.357	20	7	23.F	23.F	-112.773	25654.	45.178
NOV	0.00000					0.000	-33.403	3	6	13.F	12.F	-221.007	24711.	45.178
DEC	0.00000					0.000	-85.016	13	7	2.F	1.F	-291.093	25835.	45.178
TOTAL	721.795						-348.931						303316.	
MAX						459.571						-341.887		45.178

EMC ENGINEERS INC. EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/28/1995 16:54:59 SDL RUN 1
DENVER, CO 80227 EXISTING CONDITION OF BLDG. 7485 BOWLING ALLEY
REPORT- SS-C SYSTEM MONTHLY LOAD HOURS FOR OLD_SYSTEM TOPEKA, KS

MONTH	NUMBER OF HOURS: HOURS COOLING LOAD	HOURS HEATING LOAD	HOURS COINCIDENT COOL-HEAT LOAD	HOURS FLOATING	HOURS HEATING AVAIL.	HOURS COOLING AVAIL.	HOURS FANS ON	HOURS FANS CYCLE ON	HOURS NIGHT VENTING	HOURS FLOATING WHEN FANS ON	COINCIDENT LOADS: HEATING LOAD AT COOLING PEAK (KBTU/HR)	COINCIDENT LOADS: ELECTRIC LOAD AT COOLING PEAK (KW)
JAN	0	744	0	0	744	0	744	0	0	0	-65.977	42.228
FEB	0	672	0	0	672	0	672	0	0	0	-63.295	42.228
MAR	0	744	0	0	744	0	744	0	0	0	-63.984	42.228
APR	0	720	0	0	720	0	720	0	0	0	-4.214	42.883
MAY	384	360	0	0	360	384	744	0	0	0	0.000	17.440
JUN	720	0	0	0	0	720	720	0	0	0	0.000	45.178
JUL	744	0	0	0	0	744	744	0	0	0	0.000	44.359
AUG	744	0	0	0	0	744	744	0	0	0	0.000	45.178
SEP	716	0	0	4	0	720	720	0	0	4	0.000	44.359
OCT	20	720	0	4	720	24	744	0	0	4	0.000	44.359
NOV	0	720	0	0	720	0	720	0	0	0	-102.603	42.228
DEC	0	744	0	0	744	0	744	0	0	0	-97.331	43.539
ANNUAL	3328	5424	0	8	5424	3336	8760	0	0	8		

EMC ENGINEERS INC. EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/28/1995 16:54:59 SDL RUN 1
DENVER, CO 80227 EXISTING CONDITION OF BLDG. 7485 BOWLING ALLEY
REPORT- SS-A SYSTEM MONTHLY LOADS SUMMARY FOR NEW_SYSTEM TOPEKA, KS

MONTH	COOLING ENERGY (MBTU)	COOLING TIME OF MAX DY	COOLING TIME OF MAX HR	COOLING DRY-BULB TEMP	COOLING WET-BULB TEMP	MAXIMUM COOLING LOAD (KBTU/HR)	HEATING ENERGY (MBTU)	HEATING TIME OF MAX DY	HEATING TIME OF MAX HR	HEATING DRY-BULB TEMP	HEATING WET-BULB TEMP	MAXIMUM HEATING LOAD (KBTU/HR)	ELEC ELECTRICAL ENERGY (KWH)	ELEC MAXIMUM ELEC LOAD (KW)
JAN	0.00000					0.000	-102.975	15	7	-7.F	-8.F	-316.706	17379.	29.532
FEB	0.00000					0.000	-76.214	3	7	-5.F	-6.F	-290.670	15644.	29.532
MAR	0.00000					0.000	-56.715	3	7	14.F	12.F	-223.174	17454.	29.532
APR	0.00000					0.000	-13.241	5	7	30.F	27.F	-152.651	16941.	29.532
MAY	43.37738	31	19	84.F	76.F	271.579	-1.513	5	7	44.F	40.F	-62.143	17249.	29.532
JUN	107.01460	24	20	83.F	74.F	289.229	0.000					0.000	16885.	29.532
JUL	137.89664	17	18	88.F	80.F	327.021	0.000					0.000	17305.	29.532
AUG	134.50307	20	21	87.F	75.F	301.378	0.000					0.000	17454.	29.532
SEP	80.65082	5	18	90.F	77.F	295.504	0.000					0.000	16810.	29.532
OCT	2.07053	1	18	83.F	68.F	194.291	-6.695	20	7	23.F	23.F	-156.062	17277.	29.532
NOV	0.00000					0.000	-39.916	3	6	13.F	12.F	-209.818	16652.	29.532
DEC	0.00000					0.000	-87.936	13	7	2.F	1.F	-270.614	17407.	29.532
TOTAL	505.513						-385.205						204455.	
MAX						327.021						-316.706		29.532

EMC ENGINEERS INC. EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/28/1995 16:54:59 SDL RUN 1
DENVER, CO 80227 EXISTING CONDITION OF BLDG. 7485 BOWLING ALLEY
REPORT- SS-C SYSTEM MONTHLY LOAD HOURS FOR NEW_SYSTEM TOPEKA, KS

MONTH	HOURS COOLING LOAD	HOURS HEATING LOAD	HOURS COINCIDENT COOL-HEAT LOAD	HOURS FLOATING	HOURS HEATING AVAIL.	HOURS COOLING AVAIL.	HOURS FANS ON	HOURS FANS CYCLE ON	HOURS NIGHT VENTING	HOURS FLOATING WHEN FANS ON	COINCIDENT LOADS HEATING LOAD AT COOLING PEAK (KBTU/HR)	COINCIDENT LOADS ELECTRIC LOAD AT COOLING PEAK (KW)
JAN	0	744	0	0	744	0	744	0	0	0	-84.085	29.532
FEB	0	672	0	0	672	0	672	0	0	0	-87.891	29.532
MAR	0	742	0	2	744	0	744	0	0	2	-88.245	29.532
APR	0	524	0	196	720	0	720	0	0	196	-2.971	29.532
MAY	381	216	0	147	360	384	744	0	0	147	0.000	29.532
JUN	717	0	0	3	0	720	720	0	0	3	0.000	29.532
JUL	744	0	0	0	0	744	744	0	0	0	0.000	29.532
AUG	744	0	0	0	0	744	744	0	0	0	0.000	29.532
SEP	691	0	0	29	0	720	720	0	0	29	0.000	29.532
OCT	19	486	0	239	720	24	744	0	0	239	0.000	29.532
NOV	0	660	0	60	720	0	720	0	0	60	-111.034	29.532
DEC	0	744	0	0	744	0	744	0	0	0	-107.017	29.532
ANNUAL	3296	4788	0	676	5424	3336	8760	0	0	676		

MO	UTILITY-	ELECTRICITY	NATURAL-GAS
	TOTAL(MBTU)	164.494	322.984
JAN	PEAK(KBTU)	282.746	915.963
	DY/HR	15/20	15/ 7
	TOTAL(MBTU)	147.744	241.463
FEB	PEAK(KBTU)	282.616	841.633
	DY/HR	4/20	3/ 7
	TOTAL(MBTU)	161.537	174.193
MAR	PEAK(KBTU)	280.773	659.346
	DY/HR	4/22	4/ 7
	TOTAL(MBTU)	151.720	40.509
APR	PEAK(KBTU)	273.641	443.575
	DY/HR	5/ 9	5/ 7
	TOTAL(MBTU)	186.568	6.731
MAY	PEAK(KBTU)	471.143	124.909
	DY/HR	31/18	5/ 7
	TOTAL(MBTU)	229.229	0.000
JUN	PEAK(KBTU)	472.463	0.000
	DY/HR	28/18	30/ 1
	TOTAL(MBTU)	253.804	0.000
JUL	PEAK(KBTU)	509.661	0.000
	DY/HR	23/18	31/ 1
	TOTAL(MBTU)	255.804	0.000
AUG	PEAK(KBTU)	499.780	0.000
	DY/HR	21/19	31/ 1
	TOTAL(MBTU)	210.018	0.000
SEP	PEAK(KBTU)	483.193	0.000
	DY/HR	5/18	30/ 1
	TOTAL(MBTU)	155.571	24.928
OCT	PEAK(KBTU)	400.529	427.862
	DY/HR	1/18	20/ 7
	TOTAL(MBTU)	152.889	128.122
NOV	PEAK(KBTU)	277.030	631.396
	DY/HR	12/11	3/ 6
	TOTAL(MBTU)	164.136	279.838
DEC	PEAK(KBTU)	282.658	799.866
	DY/HR	9/20	13/ 7
	ONE YEAR	2233.514	1218.767
	USE/PEAK	509.661	915.963

ENERGY TYPE IN SITE MBTU - CATEGORY OF USE	ELECTRICITY	NATURAL-GAS
SPACE HEAT	47.65	1218.76
SPACE COOL	386.55	0.00
HVAC AUX	859.06	0.00
DOM HOT WTR	0.00	0.00
AUX SOLAR	0.00	0.00
LIGHTS	805.78	0.00
VERT TRANS	0.00	0.00
MISC EQUIP	134.53	0.00
TOTAL	2233.59	1218.76

TOTAL SITE ENERGY 3452.28 MBTU 98.0 KBTU/SQFT-YR GROSS-AREA 98.9 KBTU/SQFT-YR NET-AREA
TOTAL SOURCE ENERGY 7926.02 MBTU 225.1 KBTU/SQFT-YR GROSS-AREA 227.0 KBTU/SQFT-YR NET-AREA
PERCENT OF HOURS ANY SYSTEM ZONE OUTSIDE OF THROTTLING RANGE = 41.7
PERCENT OF HOURS ANY PLANT LOAD NOT SATISFIED = 0.0
NOTE ELECTRICITY AND/OR FUEL USED TO GENERATE ELECTRICITY IS APPORTIONED BASED ON THE YEARLY DEMAND. ALL OTHER ENERGY TYPES ARE APPORTIONED HOURLY.

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EMC       ENGINEERS     INC.      EZDOE - ELITE SOFTWARE DEVELOPMENT INC       DOE-2.1D   2/22/1995    15:32:30  SDL RUN 1
DENVER,      CO       80227       PROPOSED MODIFICATION OF BLDG. 7485    BOWLING ALLEY
REPORT- SS-A  SYSTEM MONTHLY LOADS SUMMARY FOR              OLD_SYSTEM              TOPEKA, KS
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	COOLING						HEATING						ELEC	
MONTH	COOLING ENERGY (MBTU)	TIME OF MAX DY	TIME OF MAX HR	DRY-BULB TEMP	WET-BULB TEMP	MAXIMUM COOLING LOAD (KBTU/HR)	HEATING ENERGY (MBTU)	TIME OF MAX DY	TIME OF MAX HR	DRY-BULB TEMP	WET-BULB TEMP	MAXIMUM HEATING LOAD (KBTU/HR)	ELEC-TRICAL ENERGY (KWH)	MAXIMUM ELEC LOAD (KW)
JAN	0.00000					0.000	-138.261	15	7	-7.F	-8.F	-372.470	13403.	28.541
FEB	0.00000					0.000	-104.617	3	7	-5.F	-6.F	-356.116	12038.	28.541
MAR	0.00000					0.000	-82.691	3	7	14.F	12.F	-274.520	13523.	30.677
APR	0.00000					0.000	-24.121	5	7	30.F	27.F	-190.963	16178.	42.524
MAY	40.43390	16	2	62.F	59.F	411.529	-3.699	5	7	44.F	40.F	-87.256	17170.	43.850
JUN	102.12167	24	20	83.F	74.F	317.691	0.000					0.000	14765.	42.538
JUL	139.73540	23	20	91.F	77.F	387.719	0.000					0.000	15103.	35.632
AUG	135.43437	20	20	90.F	75.F	354.280	0.000					0.000	15437.	34.994
SEP	68.64257	5	18	90.F	77.F	301.498	0.000					0.000	14472.	42.538
OCT	1.46984	1	20	70.F	64.F	142.162	-15.137	20	7	23.F	23.F	-202.622	18137.	43.522
NOV	0.00000					0.000	-64.385	3	6	13.F	12.F	-263.719	13499.	40.885
DEC	0.00000					0.000	-122.341	13	7	2.F	1.F	-331.022	13456.	28.568
TOTAL	487.838						-555.251						177183.	
MAX						411.529						-372.470		43.850

D9-28

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EMC       ENGINEERS     INC.      EZDOE - ELITE SOFTWARE DEVELOPMENT INC       DOE-2.1D   2/22/1995    15:32:30  SDL RUN 1
DENVER,      CO       80227       PROPOSED MODIFICATION OF BLDG. 7485    BOWLING ALLEY
REPORT- SS-C  SYSTEM MONTHLY LOAD HOURS FOR                 OLD_SYSTEM              TOPEKA, KS
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	NUMBER OF HOURS										--COINCIDENT LOADS--	
MONTH	HOURS COOLING LOAD	HOURS HEATING LOAD	HOURS COINCIDENT COOL-HEAT LOAD	HOURS FLOATING	HOURS HEATING AVAIL.	HOURS COOLING AVAIL.	HOURS FANS ON	HOURS FANS CYCLE ON	HOURS NIGHT VENTING	HOURS FLOATING WHEN FANS ON	HEATING LOAD AT COOLING PEAK (KBTU/HR)	ELECTRIC LOAD AT COOLING PEAK (KW)
JAN	0	744	0	0	744	0	744	0	0	0	-125.906	25.590
FEB	0	672	0	0	672	0	672	0	0	0	-128.944	25.590
MAR	0	744	0	0	744	0	744	0	0	0	-124.532	25.590
APR	0	720	0	0	720	0	720	0	0	0	-0.039	40.229
MAY	336	360	0	48	360	384	744	0	0	48	0.000	15.476
JUN	686	0	0	34	0	720	720	0	0	34	0.000	33.467
JUL	742	0	0	2	0	744	744	0	0	2	0.000	35.632
AUG	738	0	0	6	0	744	744	0	0	6	0.000	34.797
SEP	597	0	0	123	0	720	720	0	0	123	0.000	31.324
OCT	15	720	0	9	720	24	744	0	0	9	0.000	30.171
NOV	0	720	0	0	720	0	720	0	0	0	-157.099	25.590
DEC	0	744	0	0	744	0	744	0	0	0	-151.201	26.902
ANNUAL	3114	5424	0	222	5424	3336	8760	0	0	222		

MO	UTILITY-	ELECTRICITY	NATURAL-GAS
	TOTAL(MBTU)	123.430	372.295
JAN	PEAK(KBTU)	226.702	954.479
	DY/HR	15/20	15/ 7
	TOTAL(MBTU)	110.800	287.683
FEB	PEAK(KBTU)	226.571	898.991
	DY/HR	4/20	3/ 7
	TOTAL(MBTU)	121.297	226.116
MAR	PEAK(KBTU)	226.545	710.631
	DY/HR	4/20	4/ 7
	TOTAL(MBTU)	122.480	67.067
APR	PEAK(KBTU)	258.119	517.056
	DY/HR	23/22	5/ 7
	TOTAL(MBTU)	150.331	11.861
MAY	PEAK(KBTU)	407.436	253.424
	DY/HR	31/18	5/ 7
	TOTAL(MBTU)	179.186	0.000
JUN	PEAK(KBTU)	413.312	0.000
	DY/HR	24/20	30/ 1
	TOTAL(MBTU)	202.617	0.000
JUL	PEAK(KBTU)	456.684	0.000
	DY/HR	23/18	31/ 1
	TOTAL(MBTU)	205.624	0.000
AUG	PEAK(KBTU)	446.027	0.000
	DY/HR	21/19	31/ 1
	TOTAL(MBTU)	159.688	0.000
SEP	PEAK(KBTU)	418.390	0.000
	DY/HR	5/18	30/ 1
	TOTAL(MBTU)	130.337	42.293
OCT	PEAK(KBTU)	321.383	535.856
	DY/HR	1/18	20/ 7
	TOTAL(MBTU)	116.371	173.598
NOV	PEAK(KBTU)	252.426	683.803
	DY/HR	23/21	3/ 6
	TOTAL(MBTU)	123.237	330.364
DEC	PEAK(KBTU)	226.613	848.492
	DY/HR	9/20	13/ 7
	ONE YEAR	1745.397	1511.277
	USE/PEAK	456.684	954.479

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EMC       ENGINEERS      INC.        EZDOE - ELITE SOFTWARE DEVELOPMENT INC        DOE-2.1D   2/22/1995     15:32:30  PDL RUN 1
DENVER,       CO          80227       PROPOSED MODIFICATION OF BLDG. 7485     BOWLING ALLEY
REPORT- BEPS  ESTIMATED BUILDING ENERGY PERFORMANCE                                 TOPEKA, KS
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ENERGY TYPE IN SITE MBTU - CATEGORY OF USE	ELECTRICITY	NATURAL-GAS
SPACE HEAT	57.17	1511.28
SPACE COOL	319.12	0.00
HVAC AUX	428.80	0.00
DOM HOT WTR	0.00	0.00
AUX SOLAR	0.00	0.00
LIGHTS	805.78	0.00
VERT TRANS	0.00	0.00
MISC EQUIP	134.53	0.00
TOTAL	1745.40	1511.28

```
TOTAL SITE ENERGY      3256.67 MBTU     92.5 KBTU/SQFT-YR GROSS-AREA     93.3 KBTU/SQFT-YR NET-AREA
TOTAL SOURCE ENERGY    6752.71 MBTU    191.8 KBTU/SQFT-YR GROSS-AREA    193.4 KBTU/SQFT-YR NET-AREA
PERCENT OF HOURS ANY SYSTEM ZONE OUTSIDE OF THROTTLING RANGE = 62.5
PERCENT OF HOURS ANY PLANT LOAD NOT SATISFIED                =  0.0
NOTE  ELECTRICITY AND/OR FUEL USED TO GENERATE ELECTRICITY IS APPORTIONED BASED
      ON THE YEARLY DEMAND.  ALL OTHER ENERGY TYPES ARE APPORTIONED HOURLY.
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BUILDING 6914
ANNUAL ENERGY SAVINGS SUMMARY

Item	Baseline	ECO	Annual Energy Savings	Adj. Annual Energy Savings*
Annual Electric (MBTU)	581.63	378.42	203.21	145.23
Annual Natural Gas (MBTU)	573.02	578.97	-5.95	-4.25
Electric Demand June (KW)	53.52	52.06	1.46	1.04
Electric Demand July (KW)	55.05	54.80	0.25	0.18
Electric Demand August (KW)	56.69	57.50	-0.81	-0.58

*Energy savings prorated on a square foot basis:

Baseline Model Bldg 7108 (sq.ft.)	12179
ECO Model Bldg 6914 (sq.ft.)	8704
Square Footage Adjustment Factor	0.715

LIFE CYCLE COST ANALYSIS SUMMARY
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

LOCATION:	Fort Riley	REGION: 2 (Kansas)		PROJECT NO:	1406-005
PROJECT TITLE:	Feasibility Study for HVAC Upgrade			FISCAL YEAR:	1995
ANALYSIS DATE:	05/04/95	ECONOMIC LIFE:	20	PREPARED BY:	C. Wohlert

1. INVESTMENT: **BLDG 6914 - Convert (2) Existing MZs to VAV AHUs**

A. CONSTRUCTION COST		=	$26,395	
B. SIOH COST	(5.5% of 1A)	=	$1,452	
C. DESIGN COST	(6.0% of 1A)	=	$1,584	
D. TOTAL COST	(1A +1B +1C)	=	$29,431	
E. SALVAGE VALUE OF EXISTING EQUIPMENT		=	$0	
F. PUBLIC UTILITY COMPANY REBATE		=	$0	
G. TOTAL INVESTMENT	(1D -1E -1F)	=	------->	$29,431

2. ENERGY SAVINGS (+) OR COST (-):

DATE OF NISTR 85-3273-9 USED FOR DISCOUNT FACTORS: JAN '95

ENERGY SOURCE	FUEL COST $/MBTU (1)	SAVINGS MBTU/YR (2)	ANNUAL $ SAVINGS (3)	DISCOUNT FACTOR (4)	DISCOUNTED SAVINGS (5)	
A. ELECT.	$12.10	145	$1,757	15.88	$27,906	
B. DIST	$0.00	0	$0	19.16	$0	
C. NAT GAS	$4.12	(4)	($18)	18.30	($320)	
D. COAL	$0.00	0	$0	16.62	$0	
E. ELEC. DEMAND			($18)	14.88	($263)	
F. TOTAL		141	$1,722		-------->	$27,322

3. NON-ENERGY SAVINGS (+) OR COST (-)

A. ANNUAL RECURRING (+/-)

1 ANNUAL MAINTENANCE	$0	14.88	$0	
2	$0	14.88	$0	
3	$0	14.88	$0	
4 TOTAL ANNUAL DISC. SAVINGS (+) / COST (-	$0		$0	

B. NON-RECURRING (+/-)

ITEM	SAVINGS (+) COST(-) (1)	YEAR OF OCCURRENCE (2)	DISCOUNT FACTOR (3) (TABLE A-2)	DISCOUNTED SAVINGS/COST (4)
a. BASELINE EQUIP. REPLCMNT.	$0	5	0.863	$0
b.				$0
c.				$0
d. TOTAL	$0			$0

C. TOTAL NON-ENERGY DISCOUNTED SAVINGS (+) OR COST (-) (3A4 + 3Bd4) = $0

4. FIRST YEAR DOLLAR SAVINGS (+) / COSTS (-)	(2F3+3A4+(3Bd1/Economic Life))	$1,722
5. SIMPLE PAYBACK (SPB) IN YEARS (MUST BE < 10 YEARS TO QUALIFY)	(1G/4) =	17.09
6. TOTAL NET DISCOUNTED SAVINGS	(2F5 + 3C) =	$27,322
7. DISCOUNTED SAVINGS-TO-INVESTMENT RATIO (SIR) (MUST HAVE SIR > 1.25 TO QUALIFY)	(6/1G) =	0.93

ENGINEER'S OPINION OF PROBABLE COST

PROJECT	Fort Riley Feasibility Study for HVAC Upgrade	**SHEET**	1 OF 1
ENGINEER	E M C Engineers, Inc.	**DATE PREPARED**	4-May-95
	Denver, CO	**ESTIMATOR**	C. Wohlert
		CHECKED BY	A. Niemeyer

Line No.	Item Refer Code	Item Description	Unit of Measure	MATERIAL COST Quantity	MATERIAL COST Unit Cost	MATERIAL COST Total	LABOR COST Crew/ Worker	LABOR COST Hours/ Unit	LABOR COST Total	TOTAL
1		**BUILDING 6914**								
2		**PROPOSED SYSTEM MODIFICATIONS**								
3										
4										
5	VSD7.5	VARIABLE SPEED DRIVE W/ CONTRLER,7.5HP	EA.	1.0	$2,728.70	$2,729	1-ELEC	12.5	$262	$2,990
6	VSD10	VARIABLE SPEED DRIVE W/ CONTRLER,10HP	EA.	1.0	$3,197.70	$3,198	1-ELEC	12.5	$262	$3,459
7	E-TSTAT1	SINGLE SETPOINT ELEC. TSTAT, 3 WIRE	EA.	11.0	$24.23	$266	1-ELEC	0.8	$184	$451
8	WIRE#12	COPPER WIRING #12	C.L.F.	13.0	$7.41	$96	1-ELEC	0.727	$198	$294
9	VAVBX12	VAV BOX, 1200 CFM, ELEC	EA.	8.0	$271.32	$2,171	1-SHEE	1.13	$188	$2,359
10	VAVBX20	VAV BOX, 2000 CFM, ELEC	EA.	3.0	$279.07	$837	1-SHEE	1.22	$76	$913
11	REHEAT1.5	REHEAT COIL, 2ROW, 1.5'x1'	EA.	7.0	$129.36	$906	Q-5	1.32	$179	$1,085
12	REHEAT2	REHEAT COIL, 2ROW, 24"x12"	EA.	3.0	$138.57	$416	Q-5	1.32	$77	$492
13	REHEAT3	REHEAT COIL, 2ROW, 3'x1'	EA.	1.0	$154.07	$154	Q-5	1.32	$26	$180
14	CNTV0.75	CONTROL VALVE 3/4"	EA.	11.0	$153.10	$1,684	1-PLUM	0.444	$105	$1,789
15	STLPIP1	STEEL PIPE SCH. 40, 1" W/HANGERS	L.F.	400.0	$2.10	$841	Q-1	0.151	$1,171	$2,012
16	INSLPIP1	1" FIBERGLASS PIPE INSULATION, 1" THCK	L.F.	400.0	$0.62	$248	Q-14	0.073	$538	$786
17	ELE-SWIT	DDC SWITCH	EA.	1.0	$69.77	$70	1-STPI	0.5	$11	$81
18										
19										
20										
21										
22										
23										
24										
25		*EXISTING SYSTEMS DEMOLITION*								
26		ZONE DUCTWORK DEMOLITION	EA.	11.0			1-SHEE	1	$229	$229
27										
28										
29										
30										
31		**SUBTOTAL**				$13,615			$3,505	$17,120
32	OH	OVERHEAD			17%	$2,287			$589	$2,876
33	PRO	PROFIT			10%	$1,590			$409	$2,000
34	CONT	CONTINGENCY			20%	$3,499			$901	$4,399
35	**TOTAL COST**		-	-	-	$20,992	-	-	$5,404	$26,395

ENGINEER'S OPINION OF PROBABLE COST

PROJECT	Fort Riley Feasibility Study for HVAC Upgrade	**SHEET** 1	**OF** 1
		DATE PREPARED	1-Mar-95
ENGINEER	E M C Engineers, Inc.	**ESTIMATOR**	C. Wohlert
	Denver, CO	**CHECKED BY**	A. Niemeyer

Line No.	Item Refer Code	Item Description	Unit of Measure	MATERIAL COST Quantity	MATERIAL COST Unit Cost	MATERIAL COST Total	LABOR COST Crew/ Worker	LABOR COST Hours/ Unit	LABOR COST Total	TOTAL
1		**BUILDING 6914**								
2		**NON-RECURRING**								
3										
4										
5										
6										
7										
8										
9										
10										
11										
12										
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20										
21										
22										
23										
24										
25										
26										
27										
28										
29										
30										
31		**SUBTOTAL**				$0			$0	$0
32	OH	OVERHEAD			17%	$0			$0	$0
33	PRO	PROFIT			10%	$0			$0	$0
34	CONT	CONTINGENCY			20%	$0			$0	$0
35	**TOTAL COST**		-	-	-	$0	-	-	$0	$0

ENGINEER'S OPINION OF PROBABLE COST

PROJECT	Fort Riley Feasibility Study for HVAC Upgrade	SHEET 1 OF 1	
		DATE PREPARED	1-Mar-95
ENGINEER	E M C Engineers, Inc. Denver, CO	ESTIMATOR	C. Wohlert
		CHECKED BY	A. Niemeyer

Line No.	Item Refer Code	Item Description	Unit of Measure	MATERIAL COST Quantity	MATERIAL COST Unit Cost	MATERIAL COST Total	LABOR COST Crew/ Worker	LABOR COST Hours/ Unit	LABOR COST Total	TOTAL
1		**BUILDING 6914**								
2		***ANNUAL RECURRING***								
3		***ANNUAL MAINTENANCE COST - BASELINE***								
4										
5										
6										
7										
8										
9										
10										
11										
12										
13										
14										
15	**TOTAL ANNUAL MAINTENANCE COST - BASELINE**		-	-	-	$0	-	-	$0	$0
16										
17		***ANNUAL MAINTENANCE COST - NEW HVAC REPLACEMENT***								
18										
19										
20										
21										
22										
23										
24										
25										
26										
27										
28										
29	**TOTAL ANNUAL MAINTENANCE COST - BASELINE**		-	-	-	$0	-	-	$0	$0
30										
31										
32										
33										
34										
35	**TOTAL ANNUAL MAINTENANCE COST SAVINGS**		-	-	-	$0	-	-	$0	$0

DEMAND LIMITING ANALYSIS BUILDING 6914

	1993	1993	1993	1993	1993	1993	1993	1993	1993	1993	1993	1993
SUMMER PEAK (KW) =	JUL BILL	AUG BILL	SEP BILL	OCT BILL	NOV BILL	DEC BILL	JAN BILL	FEB BILL	MAR BILL	APR BILL	MAY BILL	JUN BILL
27812	7/1-8/2	8/2-9/1	9/3-10/1	10/1-11/1	11/1-12/1	12/1-1/3	1/4-2/1	2/1-3/1	3/3-4/1	4/1-5/3	5/3-6/1	6/1-7/1
	ACTUAL	ACTUAL	ACTUAL	ACTUAL	ACTUAL	ACTUAL	ACTUAL	ACTUAL	ACTUAL	ACTUAL	ACTUAL	ACTUAL
BASE CASE												
CAPACITY (KW)	32472	34452	26136	20754	26400	22752	27108	25812	23310	21834	21996	30096
POWER FACTOR (%)	99.20%	99.10%	99.10%	99.90%	99.80%	99.70%	99.50%	99.60%	99.60%	99.80%	99.60%	98.80%
CAPACITY (KVA)	32734	34765	26373	20775	26453	22820	27244	25916	23404	21878	22084	30462
80% SUMMER PEAK (KVA)	27812	27812	27812	27812	27812	27812	27812	27812	27812	27812	27812	27812
CONTRACT MINIMUM (KVA)	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643
BILLING CAPACITY (KVA)	32734	34765	27812	27812	27812	27812	27812	27812	27812	27812	27812	30462
ACTUAL OR 80% PEAK	ACTUAL	ACTUAL	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	ACTUAL
200 KVA @ $4.45	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00
NEXT 400 @ $4.25	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00
REMAINING @ $4.05	$130,142.18	$138,367.78	$110,208.22	$110,208.22	$110,208.22	$110,208.22	$110,208.22	$110,208.22	$110,208.22	$110,208.22	$110,208.22	$120,939.23
SUB DISCOUNT $.20	($6,546.77)	($6,952.98)	($5,562.38)	($5,562.38)	($5,562.38)	($5,562.38)	($5,562.38)	($5,562.38)	($5,562.38)	($5,562.38)	($5,562.38)	($6,092.31)
CAPACITY CHARGE	$126,185.40	$134,004.80	$107,235.84	$107,235.84	$107,235.84	$107,235.84	$107,235.84	$107,235.84	$107,235.84	$107,235.84	$107,235.84	$117,436.92
TOTAL ENERGY (KWH)	16,920,000	16,200,000	10,980,000	10,140,000	11,160,000	12,930,000	12,600,000	12,270,000	12,480,000	11,070,000	9,720,000	13,170,000
50*KVA @ $.03924	$64,223.85	$68,208.70	$54,566.96	$54,566.96	$54,566.96	$54,566.96	$54,566.96	$54,566.96	$54,566.96	$54,566.96	$54,566.96	$59,765.54
100*KVA @ $.03404	$111,426.10	$118,339.66	$94,671.73	$94,671.73	$94,671.73	$94,671.73	$94,671.73	$94,671.73	$94,671.73	$94,671.73	$94,671.73	$103,691.08
250*KVA @ $.03084	$252,378.15	$268,037.26	$209,965.32	$184,059.72	$214,429.80	$214,429.80	$214,429.80	$214,429.80	$214,429.80	$212,740.92	$171,106.92	$234,858.46
EXCESS @ $.02864	$109,589.57	$65,701.49	$0.00	$0.00	$1,009.19	$51,701.99	$42,250.79	$32,799.59	$38,813.99	$0.00	$0.00	$28,221.42
ENERGY CHARGE	$537,617.67	$520,287.11	$359,204.01	$333,298.41	$364,677.69	$415,370.49	$405,919.29	$396,468.09	$402,482.49	$361,979.61	$320,345.61	$426,536.49
TOTAL CHARGE LESS ECA	$663,803.07	$654,291.92	$466,439.85	$440,534.25	$471,913.53	$522,606.33	$513,155.13	$503,703.93	$509,718.33	$469,215.45	$427,581.45	$543,973.42
DEMAND REDUCTION (KW)	**0.18**	**(0.58)**	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**1.04**
CAPACITY (KW)	32472	34453	26136	20754	26400	22752	27108	25812	23310	21834	21996	30095
POWER FACTOR (%)	99.20%	99.10%	99.10%	99.90%	99.80%	99.70%	99.50%	99.60%	99.60%	99.80%	99.60%	98.80%
CAPACITY (KVA)	32734	34765	26373	20775	26453	22820	27244	25916	23404	21878	22084	30460
80% SUMMER PEAK (KVA)	27812	27812	27812	27812	27812	27812	27812	27812	27812	27812	27812	27812
CONTRACT MINIMUM (KVA)	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643
BILLING CAPACITY (KVA)	32734	34765	27812	27812	27812	27812	27812	27812	27812	27812	27812	30460
ACTUAL OR 80% PEAK	ACTUAL	ACTUAL	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	ACTUAL
200 KVA @ $4.45	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00
NEXT 400 @ $4.25	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00
REMAINING @ $4.05	$130,141.44	$138,370.13	$110,210.11	$110,210.11	$110,210.11	$110,210.11	$110,210.11	$110,210.11	$110,210.11	$110,210.11	$110,210.11	$120,934.96
SUB DISCOUNT $.20	($6,546.74)	($6,953.09)	($5,562.47)	($5,562.47)	($5,562.47)	($5,562.47)	($5,562.47)	($5,562.47)	($5,562.47)	($5,562.47)	($5,562.47)	($6,092.10)
CAPACITY CHARGE	$126,184.70	$134,007.04	$107,237.63	$107,237.63	$107,237.63	$107,237.63	$107,237.63	$107,237.63	$107,237.63	$107,237.63	$107,237.63	$117,432.86
TOTAL ENERGY (KWH)	16,920,000	16,200,000	10,980,000	10,140,000	11,160,000	12,930,000	12,600,000	12,270,000	12,480,000	11,070,000	9,720,000	13,170,000
50*KVA @ $.03924	$64,223.50	$68,209.84	$54,567.87	$54,567.87	$54,567.87	$54,567.87	$54,567.87	$54,567.87	$54,567.87	$54,567.87	$54,567.87	$59,763.47
100*KVA @ $.03404	$111,425.48	$118,341.64	$94,673.31	$94,673.31	$94,673.31	$94,673.31	$94,673.31	$94,673.31	$94,673.31	$94,673.31	$94,673.31	$103,687.49
250*KVA @ $.03084	$252,376.74	$268,041.74	$209,963.17	$184,057.57	$214,433.39	$214,433.39	$214,433.39	$214,433.39	$214,433.39	$212,738.77	$171,104.77	$234,850.33
EXCESS @ $.02864	$109,591.66	$65,694.83	$0.00	$0.00	$1,003.87	$51,696.67	$42,245.47	$32,794.27	$38,808.67	$0.00	$0.00	$28,233.50
ENERGY CHARGE	$537,617.38	$520,288.05	$359,204.36	$333,298.76	$364,678.44	$415,371.24	$405,920.04	$396,468.84	$402,483.24	$361,979.96	$320,345.96	$426,534.78
TOTAL CHARGE LESS ECA	$663,802.08	$654,295.09	$466,441.99	$440,536.39	$471,916.07	$522,608.87	$513,157.67	$503,706.47	$509,720.87	$469,217.59	$427,583.59	$543,967.65
SUMMARY												
MONTHLY DIFFERENCE	$1.00	($3.18)	($2.13)	($2.13)	($2.54)	($2.54)	($2.54)	($2.54)	($2.54)	($2.13)	($2.13)	$5.77
ANNUAL DIFFERENCE.............		**($17.66)**										

EMC ENGINEERS INC. — EZDOE - ELITE SOFTWARE DEVELOPMENT INC — DOE-2.1D 2/17/1995 16:58: 9 LDL RUN 1
DENVER, CO 80227 — EXISTING CONDITION OF BLDG. 6914 — EXCHANGE MAIN RETAIL
REPORT- LV-D DETAILS OF EXTERIOR SURFACES IN THE PROJECT — TOPEKA, KS

NUMBER OF EXTERIOR SURFACES 14 RECTANGULAR 14 OTHER 0
(U-VALUE INCLUDES INSIDE AIR FILM PLUS OUTSIDE AIR FILM AT 7.5 MPH WINDSPEED)

SURFACE	SPACE	- - - - G L A S S - - - - U-VALUE (BTU/HR-SQFT-F)	AREA (SQFT)	- - - - W A L L - - - - U-VALUE (BTU/HR-SQFT-F)	AREA (SQFT)	- W A L L + G L A S S - U-VALUE (BTU/HR-SQFT-F)	AREA (SQFT)	AZIMUTH
	SPACE_1	0.000	0.00	0.065	190.00	0.065	190.00	NORTH
	SPACE_3	0.000	0.00	0.065	360.00	0.065	360.00	NORTH
	SPACE_4	0.000	0.00	0.065	220.00	0.065	220.00	NORTH
	PLENUM_1	0.000	0.00	0.094	429.00	0.094	429.00	NORTH
	SPACE_4	0.000	0.00	0.103	420.00	0.103	420.00	EAST
	PLENUM_1	0.000	0.00	0.094	924.00	0.094	924.00	EAST
	SPACE_1	0.490	133.65	0.103	1136.35	0.144	1270.00	EAST
	SPACE_2	0.000	0.00	0.065	420.00	0.065	420.00	SOUTH
	PLENUM_1	0.000	0.00	0.094	429.00	0.094	429.00	SOUTH
	SPACE_1	0.000	0.00	0.065	360.00	0.065	360.00	SOUTH
	PLENUM_1	0.000	0.00	0.094	924.00	0.094	924.00	WEST
	SPACE_2	0.490	74.25	0.103	695.75	0.141	770.00	WEST
	SPACE_3	0.490	29.70	0.103	880.30	0.116	910.00	WEST
	PLENUM_1	0.000	0.00	0.128	17160.00	0.128	17160.00	ROOF
	SPACE_1	0.000	0.00	0.020	4445.00	0.020	4445.00	UNDERGRND
	SPACE_2	0.000	0.00	0.020	3234.00	0.020	3234.00	UNDERGRND
	SPACE_3	0.000	0.00	0.020	3570.00	0.020	3570.00	UNDERGRND
	SPACE_4	0.000	0.00	0.020	924.00	0.020	924.00	UNDERGRND

EMC ENGINEERS INC. — EZDOE - ELITE SOFTWARE DEVELOPMENT INC — DOE-2.1D 2/17/1995 16:58: 9 LDL RUN 1
DENVER, CO 80227 — EXISTING CONDITION OF BLDG. 6914 — EXCHANGE MAIN RETAIL
REPORT- LV-D DETAILS OF EXTERIOR SURFACES IN THE PROJECT — TOPEKA, KS

	AVERAGE U-VALUE/GLASS (BTU/HR-SQFT-F)	AVERAGE U-VALUE/WALLS (BTU/HR-SQFT-F)	AVERAGE U-VALUE WALLS+GLASS (BTU/HR-SQFT-F)	GLASS AREA (SQFT)	OPAQUE AREA (SQFT)	GLASS+OPAQUE AREA (SQFT)
NORTH	0.000	0.076	0.076	0.00	1199.00	1199.00
EAST	0.490	0.100	0.120	133.65	2480.35	2614.00
SOUTH	0.000	0.076	0.076	0.00	1209.00	1209.00
WEST	0.490	0.100	0.115	103.95	2500.05	2604.00
ROOF	0.000	0.128	0.128	0.00	17160.00	17160.00
ALL WALLS	0.490	0.092	0.104	237.60	7388.40	7626.00
WALLS+ROOFS	0.490	0.117	0.120	237.60	24548.40	24786.00
UNDERGRND	0.000	0.020	0.020	0.00	12173.00	12173.00
BUILDING	0.490	0.085	0.087	237.60	36721.40	36959.00

EMC ENGINEERS INC. EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/17/1995 16:58: 9 LDL RUN 1
DENVER, CO 80227 EXISTING CONDITION OF BLDG. 6914 EXCHANGE MAIN RETAIL
TOPEKA, KS
REPORT- LS-C BUILDING PEAK LOAD COMPONENTS

*** BUILDING ***

FLOOR AREA	12179	SQFT	1131	SQMT
VOLUME	188775	CUFT	5346	CUMT

	COOLING LOAD		HEATING LOAD	
TIME	AUG 24	6PM	JAN 16	6AM
DRY-BULB TEMP	93F	34C	10F	-12C
WET-BULB TEMP	76F	24C	8F	-13C

	COOLING SENSIBLE (KBTU/H)	COOLING SENSIBLE (KW)	COOLING LATENT (KBTU/H)	COOLING LATENT (KW)	HEATING SENSIBLE (KBTU/H)	HEATING SENSIBLE (KW)
WALLS	5.905	1.729	0.000	0.000	-28.955	-8.480
ROOFS	0.000	0.000	0.000	0.000	0.000	0.000
GLASS CONDUCTION	2.382	0.698	0.000	0.000	-8.267	-2.421
GLASS SOLAR	6.870	2.012	0.000	0.000	0.609	0.178
DOOR	2.310	0.677	0.000	0.000	-6.229	-1.824
INTERNAL SURFACES	0.000	0.000	0.000	0.000	0.000	0.000
UNDERGROUND SURFACES	-1.152	-0.337	0.000	0.000	-6.990	-2.047
OCCUPANTS TO SPACE	14.248	4.173	25.373	7.431	0.031	0.009
LIGHT TO SPACE	53.232	15.590	0.000	0.000	0.177	0.052
EQUIPMENT TO SPACE	9.050	2.650	0.000	0.000	0.020	0.006
PROCESS TO SPACE	0.000	0.000	0.000	0.000	0.000	0.000
INFILTRATION	7.706	2.257	11.955	3.501	-19.339	-5.664
TOTAL	100.551	29.449	37.328	10.933	-68.942	-20.191
TOTAL LOAD	137.880 KBTU/H		40.382 KW		-68.942 KBTU/H	-20.191 KW
TOTAL LOAD / AREA	11.32BTU/H.SQFT		35.690 W /SQMT		5.661BTU/H.SQFT	17.845 W /SQMT

NOTE 1) THE ABOVE LOADS EXCLUDE OUTSIDE VENTILATION AIR LOADS
---- 2) TIMES GIVEN IN STANDARD TIME FOR THE LOCATION IN CONSIDERATION

EMC ENGINEERS INC. EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/17/1995 16:58: 9 SDL RUN 1
DENVER, CO 80227 EXISTING CONDITION OF BLDG. 6914 EXCHANGE MAIN RETAIL
REPORT- SS-A SYSTEM MONTHLY LOADS SUMMARY FOR MZ-FAN-SYS TOPEKA, KS

MONTH	COOLING: COOLING ENERGY (MBTU)	COOLING: TIME OF MAX DY	COOLING: TIME OF MAX HR	COOLING: DRY-BULB TEMP	COOLING: WET-BULB TEMP	COOLING: MAXIMUM COOLING LOAD (KBTU/HR)	HEATING: HEATING ENERGY (MBTU)	HEATING: TIME OF MAX DY	HEATING: TIME OF MAX HR	HEATING: DRY-BULB TEMP	HEATING: WET-BULB TEMP	HEATING: MAXIMUM HEATING LOAD (KBTU/HR)	ELEC: ELEC-TRICAL ENERGY (KWH)	ELEC: MAXIMUM ELEC LOAD (KW)
JAN	0.00000					0.000	-97.658	15	8	-6.F	-7.F	-269.834	10297.	26.603
FEB	0.00000					0.000	-72.351	3	5	-1.F	-2.F	-234.104	9308.	26.603
MAR	0.00000					0.000	-53.819	14	4	16.F	15.F	-190.372	10790.	26.603
APR	0.00000					0.000	-15.907	5	5	31.F	29.F	-128.261	10132.	26.603
MAY	32.54854	31	18	90.F	76.F	270.086	-2.893	9	5	45.F	44.F	-81.411	10297.	26.603
JUN	79.81097	29	15	88.F	75.F	266.428	0.000					0.000	10378.	26.603
JUL	98.05341	7	18	83.F	74.F	291.979	0.000					0.000	10050.	26.603
AUG	99.07893	4	17	92.F	70.F	281.196	0.000					0.000	10790.	26.603
SEP	51.91270	7	15	92.F	76.F	256.304	0.000					0.000	10132.	26.603
OCT	0.32368	1	18	83.F	68.F	58.001	-13.963	2	2	64.F	59.F	-176.391	10050.	26.603
NOV	0.00000					0.000	-45.483	3	5	13.F	12.F	-183.070	9885.	26.603
DEC	0.00000					0.000	-86.754	15	5	8.F	7.F	-229.569	10297.	26.603
TOTAL	361.729						-388.826						122407.	
MAX						291.979						-269.834		26.603

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EMC ENGINEERS INC. EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/17/1995 16:58: 9 SDL RUN 1
DENVER, CO 80227 EXISTING CONDITION OF BLDG. 6914 EXCHANGE MAIN RETAIL
REPORT- SS-C SYSTEM MONTHLY LOAD HOURS FOR MZ-FAN-SYS TOPEKA, KS

MONTH	NUMBER OF HOURS: HOURS COOLING LOAD	HOURS HEATING LOAD	HOURS COINCIDENT COOL-HEAT LOAD	HOURS FLOATING	HOURS HEATING AVAIL.	HOURS COOLING AVAIL.	HOURS FANS ON	HOURS FANS CYCLE ON	HOURS NIGHT VENTING	HOURS FLOATING WHEN FANS ON	COINCIDENT LOADS: HEATING LOAD AT COOLING PEAK (KBTU/HR)	COINCIDENT LOADS: ELECTRIC LOAD AT COOLING PEAK (KW)
JAN	0	744	0	0	744	0	744	0	0	0	-118.080	6.882
FEB	0	672	0	0	672	0	672	0	0	0	-121.898	6.882
MAR	0	744	0	0	744	0	744	0	0	0	-117.566	6.882
APR	0	720	0	0	720	0	720	0	0	0	-0.036	6.882
MAY	338	360	0	46	360	384	744	0	0	46	0.000	26.603
JUN	688	0	0	32	0	720	720	0	0	32	0.000	26.603
JUL	740	0	0	4	0	744	744	0	0	4	0.000	26.603
AUG	727	0	0	17	0	744	744	0	0	17	0.000	26.603
SEP	513	0	0	207	0	720	720	0	0	207	0.000	26.603
OCT	10	720	0	14	720	24	744	0	0	14	0.000	6.882
NOV	0	720	0	0	720	0	720	0	0	0	-138.580	6.882
DEC	0	744	0	0	744	0	744	0	0	0	-158.907	6.882
ANNUAL	3016	5424	0	320	5424	3336	8760	0	0	320		

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EMC        ENGINEERS      INC.     EZDOE - ELITE SOFTWARE DEVELOPMENT INC      DOE-2.1D   2/17/1995     16:58: 9  PDL RUN 1
 DENVER,        CO        80227    EXISTING CONDITION OF BLDG. 6914         EXCHANGE MAIN RETAIL
REPORT- PS-B  MONTHLY PEAK AND TOTAL ENERGY USE                                   TOPEKA, KS
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MO	UTILITY-	ELECTRICITY	NATURAL-GAS
JAN	TOTAL(MBTU)	40.189	136.994
	PEAK(KBTU)	97.975	339.352
	DY/HR	31/11	15/ 8
FEB	TOTAL(MBTU)	36.203	105.060
	PEAK(KBTU)	97.975	301.456
	DY/HR	28/11	3/ 5
MAR	TOTAL(MBTU)	40.856	81.006
	PEAK(KBTU)	97.975	253.804
	DY/HR	31/10	14/ 4
APR	TOTAL(MBTU)	36.709	26.754
	PEAK(KBTU)	97.975	183.724
	DY/HR	15/ 8	5/ 5
MAY	TOTAL(MBTU)	48.449	5.682
	PEAK(KBTU)	183.475	128.996
	DY/HR	31/18	9/ 5
JUN	TOTAL(MBTU)	65.374	0.000
	PEAK(KBTU)	182.657	0.000
	DY/HR	28/16	30/ 1
JUL	TOTAL(MBTU)	70.682	0.000
	PEAK(KBTU)	187.901	0.000
	DY/HR	22/16	31/ 1
AUG	TOTAL(MBTU)	74.395	0.000
	PEAK(KBTU)	193.495	0.000
	DY/HR	11/16	31/ 1
SEP	TOTAL(MBTU)	54.750	0.000
	PEAK(KBTU)	183.507	0.000
	DY/HR	7/16	30/ 1
OCT	TOTAL(MBTU)	36.540	23.955
	PEAK(KBTU)	97.975	238.275
	DY/HR	20/10	2/ 2
NOV	TOTAL(MBTU)	37.350	69.199
	PEAK(KBTU)	97.975	245.711
	DY/HR	30/12	3/ 5
DEC	TOTAL(MBTU)	40.128	124.365
	PEAK(KBTU)	97.975	296.580
	DY/HR	30/18	15/ 5
	ONE YEAR	581.624	573.016
	USE/PEAK	193.495	339.352

ENERGY TYPE IN SITE MBTU - CATEGORY OF USE	ELECTRICITY	NATURAL-GAS
SPACE HEAT	20.56	573.02
SPACE COOL	125.35	0.00
HVAC AUX	223.60	0.00
DOM HOT WTR	0.00	0.00
AUX SOLAR	0.00	0.00
LIGHTS	182.00	0.00
VERT TRANS	0.00	0.00
MISC EQUIP	30.11	0.00
TOTAL	581.63	573.02

TOTAL SITE ENERGY 1154.64 MBTU 94.1 KBTU/SQFT-YR GROSS-AREA 94.8 KBTU/SQFT-YR NET-AREA
TOTAL SOURCE ENERGY 2319.63 MBTU 189.0 KBTU/SQFT-YR GROSS-AREA 190.5 KBTU/SQFT-YR NET-AREA
PERCENT OF HOURS ANY SYSTEM ZONE OUTSIDE OF THROTTLING RANGE = 1.4
PERCENT OF HOURS ANY PLANT LOAD NOT SATISFIED = 0.0
NOTE ELECTRICITY AND/OR FUEL USED TO GENERATE ELECTRICITY IS APPORTIONED BASED ON THE YEARLY DEMAND. ALL OTHER ENERGY TYPES ARE APPORTIONED HOURLY.

EMC ENGINEERS INC. EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 3/ 6/1995 8:26:52 SDL RUN 1
DENVER, CO 80227 PROPOSED MODIFICATION OF BLDG. 6914 EXCHANGE MAIN RETAIL
REPORT- SS-A SYSTEM MONTHLY LOADS SUMMARY FOR MZ-FAN-VAV TOPEKA, KS

	COOLING						HEATING						ELEC	
MONTH	COOLING ENERGY (MBTU)	TIME OF MAX DY	HR	DRY-BULB TEMP	WET-BULB TEMP	MAXIMUM COOLING LOAD (KBTU/HR)	HEATING ENERGY (MBTU)	TIME OF MAX DY	HR	DRY-BULB TEMP	WET-BULB TEMP	MAXIMUM HEATING LOAD (KBTU/HR)	ELEC-TRICAL ENERGY (KWH)	MAXIMUM ELEC LOAD (KW)
JAN	0.00000					0.000	-95.697	15	6	-8.F	-9.F	-191.818	5413.	20.039
FEB	0.00000					0.000	-75.433	3	7	-5.F	-6.F	-181.671	4897.	20.039
MAR	0.00000					0.000	-60.071	4	7	14.F	12.F	-155.752	5980.	26.450
APR	0.00000					0.000	-22.880	5	5	31.F	29.F	-127.864	6275.	26.597
MAY	20.47546	31	18	90.F	76.F	254.489	-5.730	1	7	38.F	36.F	-94.680	6727.	26.597
JUN	56.79328	29	15	88.F	75.F	258.417	0.000					0.000	6799.	26.597
JUL	73.85205	7	18	83.F	74.F	298.514	0.000					0.000	6356.	26.597
AUG	76.74973	4	17	92.F	70.F	292.319	0.000					0.000	7267.	26.597
SEP	33.32541	7	16	93.F	76.F	244.106	0.000					0.000	6318.	26.597
OCT	0.00523	1	19	81.F	66.F	2.122	-20.858	20	5	25.F	25.F	-135.271	6045.	26.597
NOV	0.00000					0.000	-51.876	3	6	13.F	12.F	-154.913	5347.	26.597
DEC	0.00000					0.000	-87.578	13	8	0.F	-1.F	-177.875	5413.	20.039
TOTAL	261.201						-420.124						72838.	
MAX						298.514						-191.818		26.597

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EMC ENGINEERS INC. EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 3/ 6/1995 8:26:52 SDL RUN 1
DENVER, CO 80227 PROPOSED MODIFICATION OF BLDG. 6914 EXCHANGE MAIN RETAIL
REPORT- SS-C SYSTEM MONTHLY LOAD HOURS FOR MZ-FAN-VAV TOPEKA, KS

	NUMBER OF HOURS										COINCIDENT LOADS	
MONTH	HOURS COOLING LOAD	HOURS HEATING LOAD	HOURS COINCIDENT COOL-HEAT LOAD	HOURS FLOATING	HOURS HEATING AVAIL.	HOURS COOLING AVAIL.	HOURS FANS ON	HOURS FANS CYCLE ON	HOURS NIGHT VENTING	HOURS FLOATING WHEN FANS ON	HEATING LOAD AT COOLING PEAK (KBTU/HR)	ELECTRIC LOAD AT COOLING PEAK (KW)
JAN	0	744	0	0	744	0	744	0	0	0	-128.732	0.317
FEB	0	672	0	0	672	0	672	0	0	0	-127.250	0.317
MAR	0	744	0	0	744	0	744	0	0	0	-119.578	0.317
APR	0	720	0	0	720	0	720	0	0	0	-45.637	0.317
MAY	271	360	0	113	360	384	744	0	0	113	0.000	24.930
JUN	615	0	0	105	0	720	720	0	0	105	0.000	25.411
JUL	699	0	0	45	0	744	744	0	0	45	0.000	26.597
AUG	696	0	0	48	0	744	744	0	0	48	0.000	26.597
SEP	442	0	0	278	0	720	720	0	0	278	0.000	25.124
OCT	3	720	0	21	720	24	744	0	0	21	0.000	0.317
NOV	0	720	0	0	720	0	720	0	0	0	-136.221	0.317
DEC	0	744	0	0	744	0	744	0	0	0	-136.104	0.317
ANNUAL	2726	5424	0	610	5424	3336	8760	0	0	610		

REPORT- PS-B MONTHLY PEAK AND TOTAL ENERGY USE TOPEKA, KS

MO	UTILITY-	ELECTRICITY	NATURAL-GAS
	TOTAL(MBTU)	22.224	128.095
JAN	PEAK(KBTU)	73.496	241.237
	DY/HR	31/18	15/ 6
	TOTAL(MBTU)	20.083	103.311
FEB	PEAK(KBTU)	73.496	230.554
	DY/HR	28/14	3/ 7
	TOTAL(MBTU)	23.716	85.114
MAR	PEAK(KBTU)	91.249	202.787
	DY/HR	9/18	4/ 7
	TOTAL(MBTU)	23.518	35.661
APR	PEAK(KBTU)	92.096	172.139
	DY/HR	20/12	5/ 5
	TOTAL(MBTU)	32.545	9.698
MAY	PEAK(KBTU)	175.566	134.629
	DY/HR	31/18	1/ 7
	TOTAL(MBTU)	46.551	0.000
JUN	PEAK(KBTU)	177.680	0.000
	DY/HR	28/17	30/ 1
	TOTAL(MBTU)	51.328	0.000
JUL	PEAK(KBTU)	187.037	0.000
	DY/HR	13/17	31/ 1
	TOTAL(MBTU)	56.220	0.000
AUG	PEAK(KBTU)	196.245	0.000
	DY/HR	11/16	31/ 1
	TOTAL(MBTU)	36.063	0.000
SEP	PEAK(KBTU)	176.875	0.000
	DY/HR	7/16	30/ 1
	TOTAL(MBTU)	22.712	33.067
OCT	PEAK(KBTU)	92.372	180.357
	DY/HR	13/ 8	20/ 5
	TOTAL(MBTU)	21.277	74.231
NOV	PEAK(KBTU)	91.748	201.877
	DY/HR	23/18	3/ 6
	TOTAL(MBTU)	22.182	118.790
DEC	PEAK(KBTU)	73.496	226.530
	DY/HR	30/18	13/ 8
	ONE YEAR	378.419	587.966
	USE/PEAK	196.245	241.237

REPORT- BEPS ESTIMATED BUILDING ENERGY PERFORMANCE TOPEKA, KS

ENERGY TYPE IN SITE MBTU - CATEGORY OF USE	ELECTRICITY	NATURAL-GAS
SPACE HEAT	17.53	587.97
SPACE COOL	97.13	0.00
HVAC AUX	51.64	0.00
DOM HOT WTR	0.00	0.00
AUX SOLAR	0.00	0.00
LIGHTS	182.00	0.00
VERT TRANS	0.00	0.00
MISC EQUIP	30.12	0.00
TOTAL	378.42	587.97

TOTAL SITE ENERGY 966.39 MBTU 78.7 KBTU/SQFT-YR GROSS-AREA 79.3 KBTU/SQFT-YR NET-AREA
TOTAL SOURCE ENERGY 1724.36 MBTU 140.5 KBTU/SQFT-YR GROSS-AREA 141.6 KBTU/SQFT-YR NET-AREA
PERCENT OF HOURS ANY SYSTEM ZONE OUTSIDE OF THROTTLING RANGE = 24.0
PERCENT OF HOURS ANY PLANT LOAD NOT SATISFIED = 0.0
NOTE ELECTRICITY AND/OR FUEL USED TO GENERATE ELECTRICITY IS APPORTIONED BASED ON THE YEARLY DEMAND. ALL OTHER ENERGY TYPES ARE APPORTIONED HOURLY.

BUILDING 6940
ANNUAL ENERGY SAVINGS SUMMARY

Item	Baseline	ECO	Annual Energy Savings	Adj. Annual Energy Savings*
Annual Electric (MBTU)	1026.50	732.00	294.5	706.2
Annual Natural Gas (MBTU)	3939.20	716.66	3222.5	7727.3
Electric Demand June (KW)				
Electric Demand July (KW)				
Electric Demand August (KW)				

*Energy savings prorated on a square foot basis:

Baseline Model Bldg 8069 (sq.ft.)	6600
ECO Model Bldg 6940 (sq.ft.)	15826
Square Footage Adjustment Factor	2.398

LIFE CYCLE COST ANALYSIS SUMMARY
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

LOCATION:	Fort Riley	REGION: 2 (Kansas)		PROJECT NO:	1406-005
PROJECT TITLE:	Feasibility Study for HVAC Upgrade			FISCAL YEAR:	1995
ANALYSIS DATE:	05/04/95	ECONOMIC LIFE:	20	PREPARED BY:	C. Wohlert

1. INVESTMENT: **BLDG 6940 - Replace H&V Unit with Pool Heat Recovery Unit**

A.	CONSTRUCTION COST	=	$178,678	
B.	SIOH COST	(5.5% of 1A) =	$9,827	
C.	DESIGN COST	(6.0% of 1A) =	$10,721	
D.	TOTAL COST	(1A +1B +1C) =	$199,226	
E.	SALVAGE VALUE OF EXISTING EQUIPMENT	=	$0	
F.	PUBLIC UTILITY COMPANY REBATE	=	$0	
G.	TOTAL INVESTMENT	(1D -1E -1F) =	------->	$199,226

2. ENERGY SAVINGS (+) OR COST (-):

DATE OF NISTR 85-3273-9 USED FOR DISCOUNT FACTORS: JAN '95

	ENERGY SOURCE	FUEL COST $/MBTU (1)	SAVINGS MBTU/YR (2)	ANNUAL $ SAVINGS (3)	DISCOUNT FACTOR (4)	DISCOUNTED SAVINGS (5)	
A.	ELECT.	$12.10	706	$8,545	15.88	$135,695	
B.	DIST	$0.00	0	$0	19.16	$0	
C.	NAT GAS	$4.12	7,727	$31,836	18.30	$582,608	
D.	COAL	$0.00	0	$0	16.62	$0	
E.	ELEC. DEMAND			$0	14.88	$0	
F.	TOTAL		8,434	$40,381		-------->	$718,302

3. NON-ENERGY SAVINGS (+) OR COST (-)

A. ANNUAL RECURRING (+/-)

1 ANNUAL MAINTENANCE	$0	14.88	$0
2	$0	14.88	$0
3	$0	14.88	$0
4 TOTAL ANNUAL DISC. SAVINGS (+) / COST	$0		$0

B. NON-RECURRING (+/-)

ITEM	SAVINGS (+) COST(-) (1)	YEAR OF OCCURRENCE (2)	DISCOUNT FACTOR (3) (TABLE A-2)	DISCOUNTED SAVINGS/COST (4)
a. BASELINE EQUIP. REPLCMNT.	$0	5	0.863	$0
b.				$0
c.				$0
d.				$0
e.				$0
f. TOTAL	$0			$0

C. TOTAL NON-ENERGY DISCOUNTED SAVINGS (+) OR COST (-) (3A4 + 3Bf4) = $0

4.	FIRST YEAR DOLLAR SAVINGS (+) / COSTS (-)	(2F3+3A4+(3Bf1/Economic Life))	$40,381
5.	SIMPLE PAYBACK (SPB) IN YEARS (MUST BE < 10 YEARS TO QUALIFY)	(1G/4) =	4.93
6.	TOTAL NET DISCOUNTED SAVINGS	(2F5 + 3C) =	$718,302
7.	DISCOUNTED SAVINGS-TO-INVESTMENT RATIO (SIR) (MUST HAVE SIR > 1.25 TO QUALIFY)	(6/1G) =	3.61

ENGINEER'S OPINION OF PROBABLE COST

PROJECT	Fort Riley Feasibility Study for HVAC Upgrade	**SHEET** 1 **OF** 1	
		DATE PREPARED	4-May-95
ENGINEER	E M C Engineers, Inc.	**ESTIMATOR**	C. Wohlert
	Denver, CO	**CHECKED BY**	A. Niemeyer

Line No.	Item Refer Code	Item Description	Unit of Measure	MATERIAL COST Quantity	MATERIAL COST Unit Cost	MATERIAL COST Total	LABOR COST Crew/ Worker	LABOR COST Hours/ Unit	LABOR COST Total	TOTAL
1		**BUILDING 6940**								
2		**PROPOSED SYSTEM MODIFICATIONS**								
3										
4		*NEW SYSTEMS INSTALLATION*								
5		Z-PACK Heat Recovery Unit, 24,800 CFM	EA.	1.0	$100,600	$100,600	Q-6	100	$2,011	$102,611
6	STLPIP3	STEEL PIPE SCH. 40, 3" W/HANGERS	L.F.	45.0	$6.40	$288	Q-15	0.372	$325	$612
7		FITTINGS, 5%				$14			$16	$31
8	CNTV2.5	CONTROL VALVE 2-1/2"	EA.	1.0	$935.09	$935	1-PLUM	3.556	$77	$1,012
9	INSLPIP3	3" FIBERGLASS PIPE INSULATION, 1.5" THCK	L.F.	45.0	$1.66	$75	Q-14	0.094	$78	$152
10	DUCT5000	GAL. STEEL DUCTWORK, 2000 TO 5000 LB.	LB.	2600	$0.45	$1,159	Q-10	0.087	$4,395	$5,554
11	ROFEXH25	ALUMINUM GALV. ROOF INTAKE, 25,000 CFM	EA.	1.0	$3,972.90	$3,973	Q-9	17.778	$333	$4,306
12		ROOF PENETRATION	EA.	1.0			Q-5	32	$620	$620
13	E-TSTAT1	SINGLE SETPOINT ELEC. TSTAT, 3 WIRE	EA.	1.0	$24.23	$24	1-ELEC	0.8	$17	$41
14	WIRE#12	COPPER WIRING #12	C.L.F.	1.0	$7.41	$7	1-ELEC	0.727	$15	$23
15										
16										
17										
18										
19										
20										
21										
22										
23										
24										
25										
26										
27		*EXISTING SYSTEMS DEMOLITION*								
28		AHU DEMO	TON	2.0			Q-5	17.778	$689	$689
29		DUCT DEMO	TON	0.7			Q-5	17.778	$241	$241
30										
31		**SUBTOTAL**				$107,075			$8,817	$115,892
32	OH	OVERHEAD			17%	$17,989			$1,481	$19,470
33	PRO	PROFIT			10%	$12,506			$1,030	$13,536
34	CONT	CONTINGENCY			20%	$27,514			$2,266	$29,780
35	**TOTAL COST**		-	-	-	$165,084	-	-	$13,594	$178,678

ENGINEER'S OPINION OF PROBABLE COST

PROJECT	Fort Riley Feasibility Study for HVAC Upgrade	**SHEET** 1	**OF** 1
ENGINEER	E M C Engineers, Inc.	**DATE PREPARED**	6-Mar-95
	Denver, CO	**ESTIMATOR**	C. Wohlert
		CHECKED BY	A. Niemeyer

Line No.	Item Refer Code	Item Description	Unit of Measure	MATERIAL COST			LABOR COST			TOTAL
				Quantity	Unit Cost	Total	Crew/ Worker	Hours/ Unit	Total	
1		**BUILDING 6940**								
2		**NON-RECURRING**								
3										
4		*EXISTING SYSTEM REPLACEMENT*								
5										
6										
7										
8										
9										
10										
11										
12										
13										
14										
15										
16										
17										
18										
19										
20										
21										
22		*EXISTING SYSTEMS DEMOLITION*								
23										
24										
25										
26										
27										
28										
29										
30										
31		**SUBTOTAL**				$0			$0	$0
32	OH	OVERHEAD			17%	$0			$0	$0
33	PRO	PROFIT			10%	$0			$0	$0
34	CONT	CONTINGENCY			20%	$0			$0	$0
35	**TOTAL COST**		-	-	-	$0	-	-	$0	$0

ENGINEER'S OPINION OF PROBABLE COST

PROJECT	Fort Riley Feasibility Study for HVAC Upgrade	SHEET 1	OF 1
ENGINEER	E M C Engineers, Inc.	DATE PREPARED	6-Mar-95
	Denver, CO	ESTIMATOR	C. Wohlert
		CHECKED BY	A. Niemeyer

Line No.	Item Refer Code	Item Description	Unit of Measure	MATERIAL COST Quantity	MATERIAL COST Unit Cost	MATERIAL COST Total	LABOR COST Crew/ Worker	LABOR COST Hours/ Unit	LABOR COST Total	TOTAL
1		**BUILDING 6940**								
2		***ANNUAL RECURRING***								
3		***ANNUAL MAINTENANCE COST - BASELINE***								
4										
5										
6										
7										
8										
9										
10										
11										
12										
13										
14										
15	**TOTAL ANNUAL MAINTENANCE COST - BASELINE**		-	-	-	$0	-	-	$0	$0
16										
17		***ANNUAL MAINTENANCE COST - NEW HVAC REPLACEMENT***								
18										
19										
20										
21										
22										
23										
24										
25										
26										
27										
28										
29	**TOTAL ANNUAL MAINTENANCE COST - BASELINE**		-	-	-	$0	-	-	$0	$0
30										
31										
32										
33										
34										
35	**TOTAL ANNUAL MAINTENANCE COST SAVINGS**		-	-	-	$0	-	-	$0	$0

BUILDING 8069
ANNUAL ENERGY SAVINGS SUMMARY

Item	Baseline	ECO	Annual Energy Savings	Adj. Annual Energy Savings*
Annual Electric (MBTU)	1026.50	732.00	294.5	294.5
Annual Natural Gas (MBTU)	3939.20	716.66	3222.5	3222.5
Electric Demand June (KW)				
Electric Demand July (KW)				
Electric Demand August (KW)				

*Energy savings prorated on a square foot basis:

Baseline Model Bldg 8069 (sq.ft.)	6600
ECO Model Bldg 8069 (sq.ft.)	6600
Square Footage Adjustment Factor	1.000

LIFE CYCLE COST ANALYSIS SUMMARY
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

LOCATION:	Fort Riley	REGION: 2 (Kansas)		PROJECT NO:	1406-005
PROJECT TITLE:	Feasibility Study for HVAC Upgrade			FISCAL YEAR:	1995
ANALYSIS DATE:	05/04/95	ECONOMIC LIFE:	20	PREPARED BY:	C. Wohlert

1. INVESTMENT: **BLDG 8069 - Replace H&V Units with Pool Heat Recovery Units**

A.	CONSTRUCTION COST	=	$155,877	
B.	SIOH COST	(5.5% of 1A) =	$8,573	
C.	DESIGN COST	(6.0% of 1A) =	$9,353	
D.	TOTAL COST	(1A +1B +1C) =	$173,802	
E.	SALVAGE VALUE OF EXISTING EQUIPMENT =		$0	
F.	PUBLIC UTILITY COMPANY REBATE =		$0	
G.	TOTAL INVESTMENT	(1D -1E -1F) =	------->	$173,802

2. ENERGY SAVINGS (+) OR COST (-):

DATE OF NISTR 85-3273-9 USED FOR DISCOUNT FACTORS: JAN '95

	ENERGY SOURCE	FUEL COST $/MBTU (1)	SAVINGS MBTU/YR (2)	ANNUAL $ SAVINGS (3)	DISCOUNT FACTOR (4)	DISCOUNTED SAVINGS (5)	
A.	ELECT.	$12.10	295	$3,563	15.88	$56,588	
B.	DIST	$0.00	0	$0	19.16	$0	
C.	NAT GAS	$4.12	3,223	$13,277	18.30	$242,964	
D.	COAL	$0.00	0	$0	16.62	$0	
E.	ELEC. DEMAND			$0	14.88	$0	
F.	TOTAL		3,517	$16,840		-------->	$299,551

3. NON-ENERGY SAVINGS (+) OR COST (-)

A. ANNUAL RECURRING (+/-)

1 ANNUAL MAINTENANCE	$0	14.88	$0
2	$0	14.88	$0
3	$0	14.88	$0
4 TOTAL ANNUAL DISC. SAVINGS (+) / COST	$0		$0

B. NON-RECURRING (+/-)

ITEM	SAVINGS (+) COST(-) (1)	YEAR OF OCCURRENCE (2)	DISCOUNT FACTOR (3) (TABLE A-2)	DISCOUNTED SAVINGS/COST (4)
a. BASELINE EQUIP. REPLCMNT.	$35,706	5	0.863	$30,814
b.				$0
c.				$0
d.				$0
e.				$0
f. TOTAL	$35,706			$30,814

C. TOTAL NON-ENERGY DISCOUNTED SAVINGS (+) OR COST (-) (3A4 + 3Bf4) = $30,814

4.	FIRST YEAR DOLLAR SAVINGS (+) / COSTS (-)	(2F3+3A4+(3Bf1/Economic Life))	$18,625
5.	SIMPLE PAYBACK (SPB) IN YEARS (MUST BE < 10 YEARS TO QUALIFY)	(1G/4) =	9.33
6.	TOTAL NET DISCOUNTED SAVINGS	(2F5 + 3C) =	$330,365
7.	DISCOUNTED SAVINGS-TO-INVESTMENT RATIO (SIR) (MUST HAVE SIR > 1.25 TO QUALIFY)	(6/1G) =	1.90

ENGINEER'S OPINION OF PROBABLE COST

PROJECT	Fort Riley Feasibility Study for HVAC Upgrade	**SHEET**	1 OF 1
ENGINEER	E M C Engineers, Inc.	**DATE PREPARED**	4-May-95
	Denver, CO	**ESTIMATOR**	C. Wohlert
		CHECKED BY	A. Niemeyer

Line No.	Item Refer Code	Item Description	Unit of Measure	MATERIAL COST Quantity	MATERIAL COST Unit Cost	MATERIAL COST Total	LABOR COST Crew/ Worker	LABOR COST Hours/ Unit	LABOR COST Total	TOTAL
1		**BUILDING 8069**								
2		**PROPOSED SYSTEM MODIFICATIONS**								
3										
4		*NEW SYSTEMS INSTALLATION*								
5		Z-PACK Heat Recovery Unit, 9,000 CFM	EA.	2.0	$43,650	$87,300	Q-6	63.37	$2,548	$89,848
6	STLPIP3	STEEL PIPE SCH. 40, 3" W/HANGERS	L.F.	200.0	$6.40	$1,279	Q-15	0.372	$1,443	$2,722
7		FITTINGS, 5%				$64			$72	$136
8	INSLPIP3	3" FIBERGLASS PIPE INSULATION, 1.5" THCK	L.F.	200.0	$1.66	$331	Q-14	0.094	$346	$678
9	DUCT1000	GAL. STEEL DUCTWORK, 500 TO 1000 LB.	LB.	1260.0	$0.47	$586	Q-10	0.094	$2,301	$2,887
10	ROFEXH15	ALUMINUM GALV. ROOF INTAKE, 15,000 CFM	EA.	1.0	$2,616.30	$2,616	Q-9	12.3	$231	$2,847
11	E-TSTAT1	SINGLE SETPOINT ELEC. TSTAT, 3 WIRE	EA.	1.0	$24.23	$24	1-ELEC	0.8	$17	$41
12	WIRE#12	COPPER WIRING #12	C.L.F.	1.0	$7.41	$7	1-ELEC	0.727	$15	$23
13		ROOF PENETRATION	EA.	2.0			Q-5	14	$543	$543
14										
15										
16										
17										
18										
19										
20										
21										
22										
23										
24										
25										
26										
27		*EXISTING SYSTEMS DEMOLITION*								
28		AHU DEMO	TON	4.0			Q-5	17.778	$1,379	$1,379
29										
30										
31		**SUBTOTAL**				$92,208			$8,895	$101,103
32	OH	OVERHEAD			17%	$15,491			$1,494	$16,985
33	PRO	PROFIT			10%	$10,770			$1,039	$11,809
34	CONT	CONTINGENCY			20%	$23,694			$2,286	$25,979
35	**TOTAL COST**		-	-	-	$142,163	-	-	$13,713	$155,877

ENGINEER'S OPINION OF PROBABLE COST

PROJECT	Fort Riley Feasibility Study for HVAC Upgrade	**SHEET** 1 **OF** 1	
		DATE PREPARED	4-May-95
ENGINEER	E M C Engineers, Inc.	**ESTIMATOR**	C. Wohlert
	Denver, CO	**CHECKED BY**	A. Niemeyer

Line No.	Item Refer Code	Item Description	Unit of Measure	MATERIAL COST Quantity	MATERIAL COST Unit Cost	MATERIAL COST Total	LABOR COST Crew/ Worker	LABOR COST Hours/ Unit	LABOR COST Total	TOTAL
1		**BUILDING 8069**								
2		**NON-RECURRING**								
3										
4		*EXISTING SYSTEM REPLACEMENT*								
5	AHU5400	5,400 CFM AHU, HEATING ONLY	EA.	4.0	$3,803.33	$15,213	Q-6	30	$2,413	$17,626
6	DUCT500	GAL. STEEL DUCTWORK, 200 TO 500 LB.	LB.	500.0	$0.47	$233	Q-10	0.098	$952	$1,185
7	STLPIP1.25	STEEL PIPE SCH. 40, 1.25" W/HANGERS	L.F.	120.0	$2.56	$307	Q-1	0.2	$465	$772
8		FITTINGS ADD 5%				$15			$23	$39
9	INSLPIP1.25	1.25" FIBERGLASS PIPE INSULATION, 1.5" THCK	L.F.	120.0	$1.40	$167	Q-14	0.08	$177	$344
10	CNTV1	CONTROL VALVE 1"	EA.	4.0	$190.89	$764	1-PLUM	0.471	$41	$804
11	E-TSTAT1	SINGLE SETPOINT ELEC. TSTAT, 3 WIRE	EA.	1.0	$24.23	$24	1-ELEC	0.8	$17	$41
12	WIRE#12	COPPER WIRING #12	C.L.F.	1.0	$7.41	$7	1-ELEC	0.727	$15	$23
13	DMP28X44	DAMPER W/ ACT, 28" X 44"	EA.	3.0	$278.10	$834	Q-9	2	$112	$947
14										
15										
16										
17										
18										
19										
20										
21										
22		*EXISTING SYSTEMS DEMOLITION*								
23		AHU DEMO	TON	4.0			Q-5	17.778	$1,379	$1,379
24										
25										
26										
27										
28										
29										
30										
31		**SUBTOTAL**				$17,565			$5,594	$23,159
32	OH	OVERHEAD			17%	$2,951			$940	$3,891
33	PRO	PROFIT			10%	$2,052			$653	$2,705
34	CONT	CONTINGENCY			20%	$4,514			$1,437	$5,951
35	**TOTAL COST**		-	-	-	$27,081	-	-	$8,625	$35,706

ENGINEER'S OPINION OF PROBABLE COST

PROJECT	Fort Riley Feasibility Study for HVAC Upgrade	SHEET 1 OF 1	
		DATE PREPARED	4-Mar-95
ENGINEER	E M C Engineers, Inc.	ESTIMATOR	C. Wohlert
	Denver, CO	CHECKED BY	A. Niemeyer

Line No.	Item Refer Code	Item Description	Unit of Measure	MATERIAL COST Quantity	MATERIAL COST Unit Cost	MATERIAL COST Total	LABOR COST Crew/ Worker	LABOR COST Hours/ Unit	LABOR COST Total	TOTAL
1		**BUILDING 8069**								
2		***ANNUAL RECURRING***								
3		***ANNUAL MAINTENANCE COST - BASELINE***								
4										
5										
6										
7										
8										
9										
10										
11										
12										
13										
14										
15	**TOTAL ANNUAL MAINTENANCE COST - BASELINE**		-	-	-	$0	-	-	$0	$0
16										
17		***ANNUAL MAINTENANCE COST - NEW HVAC REPLACEMENT***								
18										
19										
20										
21										
22										
23										
24										
25										
26										
27										
28										
29	**TOTAL ANNUAL MAINTENANCE COST - BASELINE**		-	-	-	$0	-	-	$0	$0
30										
31										
32										
33										
34										
35	**TOTAL ANNUAL MAINTENANCE COST SAVINGS**		-	-	-	$0	-	-	$0	$0

E M C ENGINEERS, INC.

2750 S. Wadsworth Blvd.
Suite C-200
Denver, CO 80227
(303) 988-2951

9755 Dogwood Rd.
Suite 220
Roswell, GA 30075
(404) 642-1864

JOB 1406-005 HVAC Upgrade, Ft Riley, KS
SHEET NO. ______ OF ______
CALCULATED BY A. Niemeyer DATE 3/1/95
CHECKED BY ______ DATE ______
SCALE ______

BLDG. 8069 ENERGY CALCULATIONS

Baseline Energy Use:

	ELEC. (MBTU)	N.G. (MBTU)
EZDOE Baseline:	691.94	2379.36
Pool Htg (hand calc.)	334.60	1559.90
TOTAL.	1,026.5	3,939.2

Heat Recovery System Energy Use:

	ELEC. (MBTU)	N.G. (MBTU)
EZDOE HRU Simulation	397.40	716.66
Pool Pump (hand calc)	334.60	
	732.0	716.66

Pool Dehumidification / Pool Heating / Heat Recovery Energy Use:

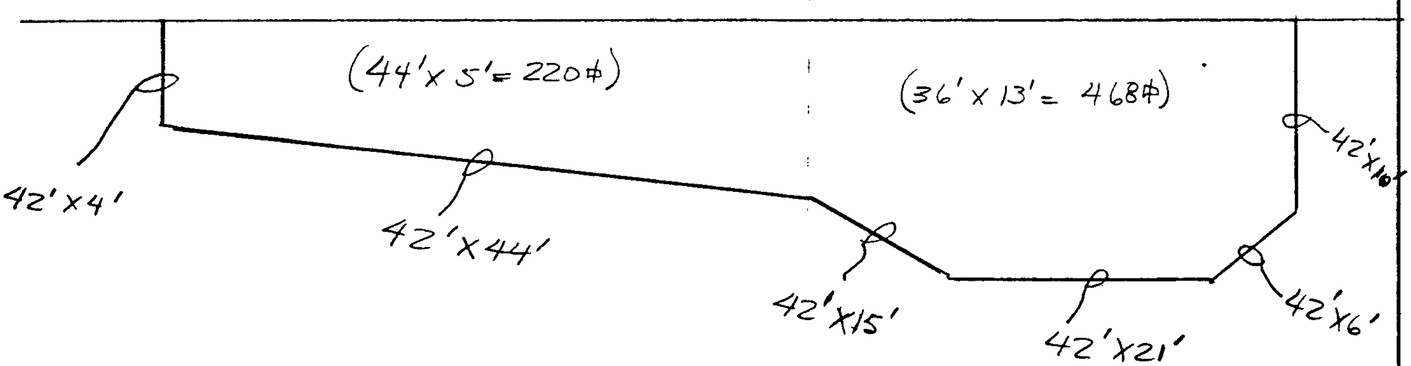
	ELEC. (MBTU)	N.G. (MBTU)
EZDOE HRU Simulation	397.40	716.66
Manf. Program for Martini 2000 Unit.	853.9	
Pool Pump. (hand calc)	334.60	
	1,585.9	716.66

E M C ENGINEERS, INC.
2750 S. Wadsworth Bvd. Suite C-200 Denver, CO 80227 (303) 988-2951
9755 Dogwood Rd. Suite 220 Roswell, GA 30075 (404) 642-1864

JOB 1406-005
SHEET NO. 1 OF 1
CALCULATED BY A. Niemeyer DATE 2-22-95
CHECKED BY DATE
SCALE

BLDG. 8069 SWIMMING POOL

82'LG x 42'WD



POOL BOTTOM & ENDS:

42' x 100' = 4200⌀

POOL SIDES:

220⌀ + 468⌀ = 688⌀
688⌀ x 2 = (1376⌀)

POOL SURFACE AREA:

82' x 42' = 3444 ⌀

ASSUMPTIONS:

- Pool Evap. rate is 164 lbs/hr (from Martini 2000 sizing program)
- U-Value of Bottom & sides of Pool is 0.02 Btuh/ft²/°F
- Avg. pool water temperature is 82°F.
- Avg. Ground temperature is 50°F
- Avg. space temperature is 80°F
- U-Value of surface water is 1.5 Btuh/ft²/°F.

POOL HEAT LOSS

EVAPORATION:

164 lbs/HR X 1000 BTU/lbs
= 164,000 BTUH X 8760 HRS
= 1,437 MBH/yr

CONDUCTION (BOTTOM & SIDES OF POOL)

(0.02)(82-50°F)(5576⌀) = 3569 BTUH

3569 BTUH X 8760 HRS = 31.3 MBH

CONDUCTION (SURFACE OF WATER)

(1.5)(82-80°)(3444⌀) = 10,332 BTUH

10,332 BTUH X 8760 HRS/yr.
= 90.5 MBH

TOTAL MBH = 1559.8 MBH

TOTAL COST TO HEAT POOL PER YR. = 1559.8 MBH X $4.12/MBH
= $6,422.00

E M C ENGINEERS, INC.
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Suite C-200
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Suite 220
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(404) 642-1864

JOB 1406-005 HVAC Upgrade, Ft Riley KS
SHEET NO. 1 OF 1
CALCULATED BY A. Niemeyer DATE 3/1/95
CHECKED BY DATE
SCALE

BLDG. 8069 Energy Calculations

Pool Htg. Electrical use:

15 HP pool pump operating year round.

15 HP X 746 W/HP = 11,190 W

11,190 W ÷ 1000 W/KW = 11.19 KW

11.19 KW X 8760 HRS/yr = 98,024.4 KWH/yr

98024.4 KWH/yr X 3413 BTU/KW = 334,600,000 BTUH or

334.6 MBH

```
*****  *****      ****   ***   *****          ***     *    ****
*          *      *   *  *   *  *             *   *    **    *   *
*****     *       *   *  *   *  *****  ***      *      *    *   *
*        *        *   *  *   *  *             **       *    *   *
*****  *****      ****   ***   *****          *****  *  ***   ****
```

B U I L D I N G   E N E R G Y   A N A L Y S I S   P R O G R A M

DEVELOPED BY
LAWRENCE BERKELEY LABORATORY/UNIVERSITY OF CALIFORNIA
AND
James J. Hirsch/HIRSCH & ASSOCIATES/(805) 482-5515

WITH MAJOR SUPPORT FROM
UNITED STATES DEPARTMENT OF ENERGY
ASSISTANT SECRETARY FOR CONSERVATION AND RENEWABLE ENERGY
OFFICE OF BUILDINGS AND COMMUNITY SYSTEMS
BUILDING SYSTEMS DIVISION

LBL RELEASE DEC 1990 version : JJHirsch PC 2.1D-017
Elite Software PC DOE-2.1D released in April 1993.

EMC ENGINEERS INC. EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 3/ 1/1995 15:57:20 LDL RUN 1
DENVER, CO 80227 BASELINE SIMULATION FOR BLDG. #8069-POOLSWIMMING POOL AREA
REPORT- LV-A GENERAL PROJECT AND BUILDING INPUT TOPEKA, KS

PERIOD OF STUDY

STARTING DATE	ENDING DATE	NUMBER OF DAYS
1 JAN 1994	31 DEC 1994	365

SITE CHARACTERISTIC DATA

STATION NAME	LATITUDE (DEG)	LONGITUDE (DEG)	ALTITUDE (FT)	TIME ZONE	BUILDING AZIMUTH (DEG)
TOPEKA, KS	39.0	96.5	1065.	6 CST	0.0

```
*** BUILDING ***

          FLOOR  AREA      6600  SQFT       613  SQMT
          VOLUME         211200  CUFT      5981  CUMT

                         COOLING  LOAD                            HEATING  LOAD
                       ====================                   ====================
        TIME             JUL 23  6PM                            JAN  4  3AM
        DRY-BULB TEMP     95F    35C                               8F    -13C
        WET-BULB TEMP     79F    26C                               7F    -14C

                       SENSIBLE              LATENT                   SENSIBLE
                   (KBTU/H)   ( KW )   (KBTU/H)  ( KW )          (KBTU/H)   ( KW )
                   --------   ------   --------  ------          --------  --------
  WALLS               3.296    0.965     0.000    0.000            -9.624    -2.819
  ROOFS              22.895    6.705     0.000    0.000           -35.393   -10.366
  GLASS CONDUCTION   32.167    9.421     0.000    0.000           -97.286   -28.492
  GLASS SOLAR       111.103   32.539     0.000    0.000             3.427     1.004
  DOOR                0.050    0.015     0.000    0.000            -0.135    -0.040
  INTERNAL SURFACES   0.000    0.000     0.000    0.000             0.000     0.000
  UNDERGROUND SURFACES -0.566 -0.166     0.000    0.000            -1.810    -0.530
  OCCUPANTS TO SPACE 13.207    3.868    21.800    6.385             2.410     0.706
  LIGHT     TO SPACE 28.080    8.224     0.000    0.000             8.390     2.457
  EQUIPMENT TO SPACE  0.000    0.000     0.000    0.000             0.000     0.000
  PROCESS   TO SPACE  0.000    0.000   198.828   58.232             0.000     0.000
  INFILTRATION       20.942    6.133    38.824   11.371          -125.891   -36.870
                   --------  -------   -------   ------          --------  --------
  TOTAL             231.174   67.705   259.452   75.987          -255.910   -74.950
  TOTAL LOAD        490.626 KBTU/H     143.692   KW        -255.910 KBTU/H  -74.950  KW
  TOTAL LOAD / AREA   74.34BTU/H.SQFT  234.347   W /SQMT    38.774BTU/H.SQFT 122.235  W /SQMT

                 ****************************************************************
                 *                                                              *
                 *  NOTE  1)THE ABOVE LOADS EXCLUDE OUTSIDE VENTILATION AIR     *
                 *  ----    LOADS                                               *
                 *        2)TIMES GIVEN IN STANDARD TIME FOR THE LOCATION       *
                 *          IN CONSIDERATION                                    *
                 *                                                              *
                 ****************************************************************
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EMC ENGINEERS INC. EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 3/ 1/1995 15:57:20 LDL RUN 1
DENVER, CO 80227 BASELINE SIMULATION FOR BLDG. #8069-POOLSWIMMING POOL AREA
REPORT- LS-D BUILDING MONTHLY LOADS SUMMARY TOPEKA, KS

MONTH	COOLING ENERGY (MBTU)	COOLING TIME OF MAX DY	COOLING TIME OF MAX HR	COOLING DRY-BULB TEMP	COOLING WET-BULB TEMP	MAXIMUM COOLING LOAD (KBTU/HR)	HEATING ENERGY (MBTU)	HEATING TIME OF MAX DY	HEATING TIME OF MAX HR	HEATING DRY-BULB TEMP	HEATING WET-BULB TEMP	MAXIMUM HEATING LOAD (KBTU/HR)	ELEC- TRICAL ENERGY (KWH)	MAXIMUM ELEC LOAD (KW)
JAN	0.24722	18	16	52.F	43.F	28.859	-73.182	4	3	8.F	7.F	-255.910	4199.	9.236
FEB	1.36480	13	16	58.F	48.F	59.207	-49.457	1	23	17.F	15.F	-204.686	3774.	9.236
MAR	9.20274	27	17	69.F	50.F	116.761	-35.871	3	8	15.F	12.F	-205.419	4239.	9.236
APR	30.67085	25	15	83.F	66.F	176.314	-10.922	4	4	33.F	31.F	-127.729	4088.	9.236
MAY	54.66166	31	17	90.F	76.F	216.780	-2.452	5	5	44.F	40.F	-81.912	4199.	9.236
JUN	70.07397	19	18	86.F	75.F	215.486	-0.435	2	5	50.F	49.F	-34.389	4082.	9.236
JUL	78.81918	23	17	95.F	79.F	231.174	-0.004	30	6	62.F	59.F	-4.167	4153.	9.236
AUG	76.94143	24	17	93.F	76.F	229.406	-0.080	4	6	54.F	53.F	-16.334	4291.	9.236
SEP	45.39871	6	16	93.F	75.F	218.245	-3.801	18	1	50.F	48.F	-70.688	4036.	9.236
OCT	23.49690	11	16	85.F	68.F	157.353	-12.606	20	7	23.F	22.F	-117.428	4153.	9.236
NOV	6.46319	7	15	73.F	58.F	92.995	-31.216	30	5	29.F	26.F	-150.566	4093.	9.236
DEC	0.33447	21	15	55.F	44.F	26.488	-67.893	15	5	8.F	7.F	-211.993	4147.	9.236
TOTAL	397.675						-287.917						49454.	
MAX						231.174						-255.910		9.236

D9-61

MESSAGE LIST FROM SYSTEMS PROGRAM

WARNING*
SYSTEM POOL-H&V'S MAY HAVE INADEQUATE HEATING CAPABILIT Y
(CHECK HEATING-CAPACITY,HEAT-SET-T,PRE-HEAT-T AND MAX-SUPPLY-T FOR CONSISTENCY)

EMC ENGINEERS INC. EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 3/ 1/1995 15:57:20 SDL RUN 1
DENVER, CO 80227 BASELINE SIMULATION FOR BLDG. #8069-POOLSWIMMING POOL AREA
REPORT- SV-A SYSTEM DESIGN PARAMETERS POOL-H&V'S TOPEKA, KS

SYSTEM NAME	ALTITUDE MULTIPLIER
POOL-H&V'S	1.040

SUPPLY FAN (CFM)	ELEC (KW)	DELTA-T (F)	RETURN FAN (CFM)	ELEC (KW)	DELTA-T (F)	OUTSIDE AIR RATIO	COOLING CAPACITY (KBTU/HR)	SENSIBLE (SHR)	HEATING CAPACITY (KBTU/HR)	COOLING EIR (BTU/BTU)	HEATING EIR (BTU/BTU)
18720.	14.040	2.3	0.	0.000	0.0	0.092	0.000	0.000	-979.020	0.00	0.00

ZONE NAME	SUPPLY FLOW	EXHAUST FLOW	FAN (KW)	MINIMUM FLOW RATIO	OUTSIDE AIR FLOW	COOLING CAPACITY (KBTU/HR)	SENSIBLE (SHR)	EXTRACTION RATE (KBTU/HR)	HEATING CAPACITY (KBTU/HR)	ADDITION RATE (KBTU/HR)	MULTIPLIER
pool-area	18720.	0.	0.000	1.000	1726.	0.00	0.00	0.00	0.00	-961.35	1.0

EMC ENGINEERS INC. EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 3/ 1/1995 15:57:20 SDL RUN 1
DENVER, CO 80227 BASELINE SIMULATION FOR BLDG. #8069-POOLSWIMMING POOL AREA
REPORT- SS-A SYSTEM MONTHLY LOADS SUMMARY FOR POOL-H&V'S TOPEKA, KS

MONTH	COOLING: COOLING ENERGY (MBTU)	COOLING: TIME OF MAX DY	COOLING: TIME OF MAX HR	COOLING: DRY-BULB TEMP	COOLING: WET-BULB TEMP	COOLING: MAXIMUM COOLING LOAD (KBTU/HR)	HEATING: HEATING ENERGY (MBTU)	HEATING: TIME OF MAX DY	HEATING: TIME OF MAX HR	HEATING: DRY-BULB TEMP	HEATING: WET-BULB TEMP	HEATING: MAXIMUM HEATING LOAD (KBTU/HR)	ELEC: ELEC-TRICAL ENERGY (KWH)	ELEC: MAXIMUM ELEC LOAD (KW)
JAN	0.00000					0.000	-368.646	15	3	-8.F	-9.F	-933.079	14645.	23.276
FEB	0.00000					0.000	-280.547	3	7	-5.F	-6.F	-871.536	13209.	23.276
MAR	0.00000					0.000	-232.255	3	7	14.F	12.F	-660.015	14685.	23.276
APR	0.00000					0.000	-89.756	5	7	30.F	27.F	-438.189	14197.	23.276
MAY	0.00000					0.000	-25.859	1	6	37.F	37.F	-336.479	14645.	23.276
JUN	0.00000					0.000	0.000					0.000	14191.	23.276
JUL	0.00000					0.000	0.000					0.000	14598.	23.276
AUG	0.00000					0.000	0.000					0.000	14737.	23.276
SEP	0.00000					0.000	0.000					0.000	14145.	23.276
OCT	0.00000					0.000	-89.183	20	8	23.F	22.F	-524.764	14598.	23.276
NOV	0.00000					0.000	-197.197	3	4	13.F	12.F	-636.586	14202.	23.276
DEC	0.00000					0.000	-332.862	13	8	0.F	-1.F	-804.439	14593.	23.276
TOTAL	0.000						-1616.305						172450.	
MAX						0.000						-933.079		23.276

D9-62

EMC ENGINEERS INC. EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 3/ 1/1995 15:57:20 SDL RUN 1
DENVER, CO 80227 BASELINE SIMULATION FOR BLDG. #8069-POOLSWIMMING POOL AREA
REPORT- SS-C SYSTEM MONTHLY LOAD HOURS FOR POOL-H&V'S TOPEKA, KS

MONTH	HOURS COOLING LOAD	HOURS HEATING LOAD	HOURS COINCIDENT COOL-HEAT LOAD	HOURS FLOATING	HOURS HEATING AVAIL.	HOURS COOLING AVAIL.	HOURS FANS ON	HOURS FANS CYCLE ON	HOURS NIGHT VENTING	HOURS FLOATING WHEN FANS ON	COINCIDENT LOADS: HEATING LOAD AT COOLING PEAK (KBTU/HR)	COINCIDENT LOADS: ELECTRIC LOAD AT COOLING PEAK (KW)
JAN	0	744	0	0	744	0	744	0	0	0	-413.794	14.040
FEB	0	672	0	0	672	0	672	0	0	0	-419.951	14.040
MAR	0	738	0	6	744	0	744	0	0	6	-407.759	14.040
APR	0	629	0	91	720	0	720	0	0	91	-195.411	14.040
MAY	0	269	0	475	360	0	744	0	0	475	0.000	14.040
JUN	0	0	0	720	0	0	720	0	0	720	0.000	14.040
JUL	0	0	0	744	0	0	744	0	0	744	0.000	14.040
AUG	0	0	0	744	0	0	744	0	0	744	0.000	14.040
SEP	0	0	0	720	0	0	720	0	0	720	0.000	14.040
OCT	0	609	0	135	720	0	744	0	0	135	-308.676	14.040
NOV	0	696	0	24	720	0	720	0	0	24	-495.312	14.040
DEC	0	744	0	0	744	0	744	0	0	0	-471.069	14.040
ANNUAL	0	5101	0	3659	5424	0	8760	0	0	3659		

EMC ENGINEERS INC. EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 3/ 1/1995 15:57:20 SDL RUN 1
DENVER, CO 80227 BASELINE SIMULATION FOR BLDG. #8069-POOLSWIMMING POOL AREA
REPORT- SS-K SPACE TEMPERATURE SUMMARY POOL-H&V'S TOPEKA, KS

	AVERAGE SPACE TEMP					AVERAGE TEMPERATURE DIFFERENCE			SUMMED TEMP DIFFERENCE		
MONTH	ALL HOURS (F)	COOLING HOURS (F)	HEATING HOURS (F)	FAN ON HOURS (F)	FAN OFF HOURS (F)	BETWEEN OUTDOOR& ROOM AIR ALL HOURS (F)	BETWEEN OUTDOOR& ROOM AIR FAN ON HOURS (F)	BETWEEN OUTDOOR& ROOM AIR FAN OFF HOURS (F)	BETWEEN OUTDOOR& ROOM AIR HEATING HOURS (F)	BETWEEN OUTDOOR& ROOM AIR ALL HOURS (F)	HUMIDITY RATIO DIFFERENCE BETWEEN OUTDOOR AND ROOM AIR (FRAC.OR MULT.)
JAN	69.77		69.77	69.77	0.00	-43.96	-43.96	0.00	1362.63	1362.63	-0.00431
FEB	70.84		70.84	70.84	0.00	-39.16	-39.16	0.00	1096.42	1096.42	-0.00434
MAR	72.38		72.33	72.38	0.00	-32.11	-32.11	0.00	993.15	995.31	-0.00436
APR	75.80		75.10	75.80	0.00	-19.02	-19.02	0.00	535.82	570.74	-0.00444
MAY	76.94		76.73	76.94	0.00	-10.85	-10.85	0.00	201.44	336.36	-0.00346
JUN	79.92			79.92	0.00	-6.28	-6.28	0.00			-0.00243
JUL	83.52			83.52	0.00	-6.34	-6.34	0.00			-0.00246
AUG	85.00			85.00	0.00	-5.87	-5.87	0.00			-0.00246
SEP	72.90			72.90	0.00	-5.36	-5.36	0.00			-0.00235
OCT	75.17		74.52	75.17	0.00	-17.28	-17.28	0.00	500.99	536.49	-0.00447
NOV	72.51		72.33	72.51	0.00	-28.40	-28.40	0.00	845.39	852.01	-0.00445
DEC	70.08		70.08	70.08	0.00	-40.04	-40.04	0.00	1241.10	1241.10	-0.00430
ANNUAL	75.44	0.00	72.27	75.44	0.00	-21.14	-21.14	0.00	6776.92	7718.78	-0.00365

EMC ENGINEERS INC. EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 3/ 1/1995 15:57:20 SDL RUN 1
DENVER, CO 80227 BASELINE SIMULATION FOR BLDG. #8069-POOLSWIMMING POOL AREA
REPORT- SS-N RELATIVE HUMIDITY SCATTER PLOT FOR POOL-H&V'S TOPEKA, KS

TOTAL HOURS AT RELATIVE HUMIDITY LEVEL AND TIME OF DAY

HOUR	1AM	2	3	4	5	6	7	8	9	10	11	12	1PM	2	3	4	5	6	7	8	9	10	11	12	TOTAL
81-100	54	65	75	85	88	101	63	45	34	23	18	12	13	9	11	13	12	11	14	18	25	28	33	46	896
71-80	66	63	55	53	52	47	76	72	53	51	36	34	28	24	16	13	16	19	29	44	56	73	72	63	1111
61-70	48	43	44	38	46	41	42	63	75	61	64	51	44	40	34	38	35	42	52	67	62	52	53	55	1190
51-60	49	48	46	43	32	33	45	42	57	78	75	81	82	84	78	78	89	88	89	75	72	63	54	49	1530
41-50	81	76	75	81	81	79	78	83	88	90	107	116	120	119	123	118	109	115	109	93	82	82	83	84	2272
31-40	66	70	69	64	64	64	60	60	58	62	65	71	77	88	101	103	101	89	72	68	68	67	69	67	1743
0-30	1	0	1	1	2	0	1	0	0	0	0	0	1	1	2	2	3	1	0	0	0	0	1	1	18

EMC ENGINEERS INC. EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 3/ 1/1995 15:57:20 SDL RUN 1
DENVER, CO 80227 BASELINE SIMULATION FOR BLDG. #8069-POOLSWIMMING POOL AREA
REPORT- SS-O TEMPERATURE SCATTER PLOT POOL-H&V'S FOR pool-area TOPEKA, KS

TOTAL HOURS AT TEMPERATURE LEVEL AND TIME OF DAY

HOUR	1AM	2	3	4	5	6	7	8	9	10	11	12	1PM	2	3	4	5	6	7	8	9	10	11	12	TOTAL
ABOVE 85	12	9	7	3	1	0	6	13	30	43	58	81	92	105	111	112	112	104	83	57	36	26	21	15	1137
81-85	31	25	17	21	19	17	26	36	40	50	48	40	38	34	42	42	41	38	37	48	53	43	37	36	859
76-80	55	58	53	47	54	48	61	66	64	70	78	72	74	74	69	71	65	68	71	67	76	73	68	61	1563
71-75	174	161	163	151	147	167	146	140	157	151	142	137	129	129	122	120	127	131	143	155	153	167	162	164	3538
66-70	76	92	102	115	114	106	107	96	66	47	35	31	29	21	19	18	18	21	28	34	41	43	63	73	1395
61-65	8	10	11	14	17	13	8	7	4	1	2	2	1	0	0	0	0	1	1	2	4	9	9	9	133
BELOW 60	9	10	12	14	13	14	11	7	4	3	2	2	2	2	2	2	2	2	2	2	2	4	5	7	135

EMC ENGINEERS INC. EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 3/ 1/1995 15:57:20 PDL RUN 1
DENVER, CO 80227 BASELINE SIMULATION FOR BLDG. #8069-POOLSWIMMING POOL AREA
REPORT- PV-A EQUIPMENT SIZES TOPEKA, KS

EQUIPMENT	SIZE (MBTU/H)	NUMBER INSTD	NUMBER AVAIL	SIZE (MBTU/H)	NUMBER INSTD	NUMBER AVAIL	SIZE (MBTU/H)	NUMBER INSTD	NUMBER AVAIL	SIZE (MBTU/H)	NUMBER INSTD	NUMBER AVAIL	SIZE (MBTU/H)	NUMBER INSTD	NUMBER AVAIL	SIZE (MBTU/H)	NUMBER INSTD	NUMBER AVAIL
HW-BOILER	0.939	1	1															

EMC ENGINEERS INC. EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 3/ 1/1995 15:57:20 PDL RUN 1
DENVER, CO 80227 BASELINE SIMULATION FOR BLDG. #8069-POOLSWIMMING POOL AREA
REPORT- PV-B COST REFERENCE DATA (USED FOR DEFAULT COSTS) TOPEKA, KS

EQUIPMENT	SIZE (MBTU)	UNIT COST (K$)	INSTALD COST FACTOR	CONSUM-ABLES ($/HR)	MAINTA-NANCE (HRS/YR)	EQPMT LIFE (HRS)	HOURS ALREADY USED	HRS TO MINOR OVHAUL	MINOR OVHAUL COST ($)	HRS TO MAJOR OVHAUL	MAJOR OVHAUL COST ($)
HW-BOILER	40.000	300.000	1.400	0.000	8.0	220000.	0.	10000.	2000.	50000.	25000.

EMC ENGINEERS INC. EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 3/ 1/1995 15:57:20 PDL RUN 1
DENVER, CO 80227 BASELINE SIMULATION FOR BLDG. #8069-POOLSWIMMING POOL AREA
REPORT- PS-B MONTHLY PEAK AND TOTAL ENERGY USE TOPEKA, KS

MO	UTILITY-	ELECTRICITY	NATURAL-GAS
	TOTAL(MBTU)	67.760	514.419
JAN	PEAK(KBTU)	103.486	1174.249
	DY/HR	31/22	15/ 3
	TOTAL(MBTU)	60.960	404.749
FEB	PEAK(KBTU)	103.486	1109.380
	DY/HR	28/22	3/ 7
	TOTAL(MBTU)	66.101	348.447
MAR	PEAK(KBTU)	103.486	880.326
	DY/HR	31/22	3/ 7
	TOTAL(MBTU)	57.574	146.750
APR	PEAK(KBTU)	103.486	629.963
	DY/HR	16/ 9	5/ 7
	TOTAL(MBTU)	53.240	44.590
MAY	PEAK(KBTU)	103.486	511.693
	DY/HR	9/ 7	1/ 6
	TOTAL(MBTU)	48.455	0.000
JUN	PEAK(KBTU)	79.475	0.000
	DY/HR	30/22	30/ 1
	TOTAL(MBTU)	49.845	0.000
JUL	PEAK(KBTU)	79.475	0.000
	DY/HR	31/20	31/ 1
	TOTAL(MBTU)	50.318	0.000
AUG	PEAK(KBTU)	79.475	0.000
	DY/HR	31/22	31/ 1
	TOTAL(MBTU)	48.297	0.000
SEP	PEAK(KBTU)	79.475	0.000
	DY/HR	30/22	30/ 1
	TOTAL(MBTU)	59.248	147.824
OCT	PEAK(KBTU)	103.486	728.912
	DY/HR	31/22	20/ 8
	TOTAL(MBTU)	62.717	298.842
NOV	PEAK(KBTU)	103.486	854.375
	DY/HR	30/22	3/ 4
	TOTAL(MBTU)	67.474	473.741
DEC	PEAK(KBTU)	103.486	1037.745
	DY/HR	31/20	13/ 8
	ONE YEAR	691.989	2379.362
	USE/PEAK	103.486	1174.249

HEATING LOADS	MBTU SUPPLIED	PCT OF TOTAL LOAD
HW-BOILER	1648.5	100.0
LOAD SATISFIED	1648.5	100.0
TOTAL LOAD ON PLANT	1648.5	

ELECTRICAL LOADS	MBTU SUPPLIED	PCT OF TOTAL LOAD
ELECTRICITY	692.0	100.0
LOAD SATISFIED	692.0	100.0
TOTAL LOAD ON PLANT	692.0	

EMC ENGINEERS INC. EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 3/ 1/1995 15:57:20 PDL RUN 1
DENVER, CO 80227 BASELINE SIMULATION FOR BLDG. #8069-POOLSWIMMING POOL AREA
REPORT- PS-D PLANT LOADS SATISFIED TOPEKA, KS

SUMMARY OF LOADS MET

TYPE OF LOAD	TOTAL LOAD (MBTU)	LOAD SATISFIED (MBTU)	TOTAL OVERLOAD (MBTU)	PEAK OVERLOAD (MBTU)	HOURS OVERLOADED
HEATING LOADS	1648.5	1648.5	0.000	0.000	0
ELECTRICAL LOADS	692.0	692.0	0.000	0.000	0

ENERGY TYPE IN SITE MBTU - CATEGORY OF USE	ELECTRICITY	NATURAL-GAS
SPACE HEAT	86.12	2379.36
SPACE COOL	0.00	0.00
HVAC AUX	436.97	0.00
DOM HOT WTR	0.00	0.00
AUX SOLAR	0.00	0.00
LIGHTS	168.85	0.00
VERT TRANS	0.00	0.00
MISC EQUIP	0.00	0.00
TOTAL	691.94	2379.36

TOTAL SITE ENERGY 3071.35 MBTU 465.4 KBTU/SQFT-YR GROSS-AREA 465.4 KBTU/SQFT-YR NET-AREA
TOTAL SOURCE ENERGY 4457.41 MBTU 675.4 KBTU/SQFT-YR GROSS-AREA 675.4 KBTU/SQFT-YR NET-AREA
PERCENT OF HOURS ANY SYSTEM ZONE OUTSIDE OF THROTTLING RANGE = 0.2
PERCENT OF HOURS ANY PLANT LOAD NOT SATISFIED = 0.0
NOTE ELECTRICITY AND/OR FUEL USED TO GENERATE ELECTRICITY IS APPORTIONED BASED ON THE YEARLY DEMAND. ALL OTHER ENERGY TYPES ARE APPORTIONED HOURLY.

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*****  *****    ****   ***  *****          ***      *   ****
*          *    *   *  *   * *             *   *    **   *   *
*****     *     *   *  *   * *****  ***       *      *   *   *
*        *      *   *  *   * *              **       *   *   *
*****  *****    ****   ***  *****         *****  * ***  ****
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B U I L D I N G   E N E R G Y   A N A L Y S I S   P R O G R A M

DEVELOPED BY
LAWRENCE BERKELEY LABORATORY/UNIVERSITY OF CALIFORNIA
AND
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WITH MAJOR SUPPORT FROM
UNITED STATES DEPARTMENT OF ENERGY
ASSISTANT SECRETARY FOR CONSERVATION AND RENEWABLE ENERGY
OFFICE OF BUILDINGS AND COMMUNITY SYSTEMS
BUILDING SYSTEMS DIVISION

LBL RELEASE DEC 1990 version : JJHirsch PC 2.1D-017
Elite Software PC DOE-2.1D released in April 1993.

PERIOD OF STUDY

STARTING DATE	ENDING DATE	NUMBER OF DAYS
1 JAN 1994	15 MAY 1994	135
1 OCT 1994	31 DEC 1994	92

SITE CHARACTERISTIC DATA

STATION NAME	LATITUDE (DEG)	LONGITUDE (DEG)	ALTITUDE (FT)	TIME ZONE	BUILDING AZIMUTH (DEG)
TOPEKA, KS	39.0	96.5	1065.	6 CST	0.0

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    EMC      ENGINEERS      INC.       EZDOE - ELITE SOFTWARE DEVELOPMENT INC        DOE-2.1D    3/ 4/1995    10:38:23  LDL RUN 1
    DENVER,       CO        80227      HEATING SEASON FOR BLDG. #8069-POOL     SWIMMING POOL AREA
REPORT- LS-C BUILDING PEAK LOAD COMPONENTS      HRU simulation                       TOPEKA, KS
-----------------------------------------------------------------------------------------------------------------------------

*** BUILDING ***

                   FLOOR  AREA      6600  SQFT       613  SQMT
                   VOLUME         211200  CUFT      5981  CUMT

                                        COOLING  LOAD                                        HEATING  LOAD
                                    ====================                                ====================
               TIME                    MAY 12  6PM                                         JAN  4  3AM
               DRY-BULB TEMP             82F    28C                                          8F    -13C
               WET-BULB TEMP             64F    18C                                          7F    -14C

                                 SENSIBLE            LATENT                                  SENSIBLE
                             (KBTU/H)    ( KW )  (KBTU/H)  ( KW )                       (KBTU/H)  ( KW )
                             --------    ------  --------  ------                       --------  --------
    WALLS                       0.954     0.279     0.000   0.000                         -9.624    -2.819
    ROOFS                      12.920     3.784     0.000   0.000                        -35.393   -10.366
    GLASS CONDUCTION           14.043     4.113     0.000   0.000                        -97.286   -28.492
    GLASS SOLAR               115.769    33.906     0.000   0.000                          3.427     1.004
    DOOR                        0.021     0.006     0.000   0.000                         -0.135    -0.040
    INTERNAL SURFACES           0.000     0.000     0.000   0.000                          0.000     0.000
    UNDERGROUND SURFACES       -1.476    -0.432     0.000   0.000                         -1.810    -0.530
    OCCUPANTS TO SPACE         12.622     3.697    21.800   6.385                          2.410     0.706
    LIGHT     TO SPACE         26.042     7.627     0.000   0.000                          8.390     2.457
    EQUIPMENT TO SPACE          0.000     0.000     0.000   0.000                          0.000     0.000
    PROCESS   TO SPACE          0.000     0.000   198.828  58.232                          0.000     0.000
    INFILTRATION               13.803     4.042     1.190   0.349                       -125.891   -36.870
                             --------   -------   -------  ------                       --------  --------
    TOTAL                     194.696    57.022   221.818  64.965                       -255.910   -74.950
    TOTAL LOAD                416.514 KBTU/H      121.987  KW                  -255.910 KBTU/H      -74.950  KW
    TOTAL LOAD / AREA           63.11BTU/H.SQFT   198.947   W /SQMT              38.774BTU/H.SQFT   122.235   W /SQMT

                                  ***************************************************************
                                  *                                                             *
                                  *  NOTE  1)THE ABOVE LOADS EXCLUDE OUTSIDE VENTILATION AIR    *
                                  *  ----    LOADS                                              *
                                  *        2)TIMES GIVEN IN STANDARD TIME FOR THE LOCATION      *
                                  *          IN CONSIDERATION                                   *
                                  *                                                             *
                                  ***************************************************************
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EMC ENGINEERS INC. EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 3/ 4/1995 10:38:23 SDL RUN 1
DENVER, CO 80227 HEATING SEASON FOR BLDG. #8069-POOL SWIMMING POOL AREA
REPORT- LS-D BUILDING MONTHLY LOADS SUMMARY HRU simulation TOPEKA, KS

MONTH	COOLING ENERGY (MBTU)	COOLING TIME OF MAX DY	COOLING TIME OF MAX HR	COOLING DRY-BULB TEMP	COOLING WET-BULB TEMP	MAXIMUM COOLING LOAD (KBTU/HR)	HEATING ENERGY (MBTU)	HEATING TIME OF MAX DY	HEATING TIME OF MAX HR	HEATING DRY-BULB TEMP	HEATING WET-BULB TEMP	MAXIMUM HEATING LOAD (KBTU/HR)	ELEC-TRICAL ENERGY (KWH)	MAXIMUM ELEC LOAD (KW)
JAN	0.24722	18	16	52.F	43.F	28.859	-73.182	4	3	8.F	7.F	-255.910	4199.	9.236
FEB	1.36480	13	16	58.F	48.F	59.207	-49.457	1	23	17.F	15.F	-204.686	3774.	9.236
MAR	9.20274	27	17	69.F	50.F	116.761	-35.871	3	8	15.F	12.F	-205.419	4239.	9.236
APR	30.67085	25	15	83.F	66.F	176.314	-10.922	4	4	33.F	31.F	-127.729	4088.	9.236
MAY	22.36159	12	17	82.F	64.F	194.696	-2.054	5	5	44.F	40.F	-81.912	2021.	9.236
JUN	0.00000					0.000	0.000					0.000	0.	0.000
JUL	0.00000					0.000	0.000					0.000	0.	0.000
AUG	0.00000					0.000	0.000					0.000	0.	0.000
SEP	0.00000					0.000	0.000					0.000	0.	0.000
OCT	23.55433	1	16	85.F	68.F	159.061	-12.471	20	7	23.F	22.F	-117.428	4153.	9.236
NOV	6.46319	7	15	73.F	58.F	92.995	-31.216	30	5	29.F	26.F	-150.566	4093.	9.236
DEC	0.33447	21	15	55.F	44.F	26.488	-67.893	15	5	8.F	7.F	-211.993	4147.	9.236
TOTAL	94.199						-283.065						30714.	
MAX						194.696						-255.910		9.236

D9-71

MESSAGE LIST FROM SYSTEMS PROGRAM

WARNING*
SYSTEM POOL-H&V'S MAY HAVE INADEQUATE HEATING CAPABILIT Y
(CHECK HEATING-CAPACITY,HEAT-SET-T,PRE-HEAT-T AND MAX-SUPPLY-T FOR CONSISTENCY)

EMC ENGINEERS INC. EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 3/ 4/1995 10:38:23 SDL RUN 1
DENVER, CO 80227 HEATING SEASON FOR BLDG. #8069-POOL SWIMMING POOL AREA
REPORT- SV-A SYSTEM DESIGN PARAMETERS POOL-H&V'S TOPEKA, KS

SYSTEM NAME	ALTITUDE MULTIPLIER
POOL-H&V'S	1.040

SUPPLY FAN (CFM)	ELEC (KW)	DELTA-T (F)	RETURN FAN (CFM)	ELEC (KW)	DELTA-T (F)	OUTSIDE AIR RATIO	COOLING CAPACITY (KBTU/HR)	SENSIBLE (SHR)	HEATING CAPACITY (KBTU/HR)	COOLING EIR (BTU/BTU)	HEATING EIR (BTU/BTU)
18720.	14.040	2.3	0.	0.000	0.0	0.092	0.000	0.000	-979.020	0.00	0.00

ZONE NAME	SUPPLY FLOW	EXHAUST FLOW	FAN (KW)	MINIMUM FLOW RATIO	OUTSIDE AIR FLOW	COOLING CAPACITY (KBTU/HR)	SENSIBLE (SHR)	EXTRACTION RATE (KBTU/HR)	HEATING CAPACITY (KBTU/HR)	ADDITION RATE (KBTU/HR)	MULTIPLIER
pool-area	18720.	0.	0.000	1.000	1726.	0.00	0.00	0.00	0.00	-961.35	1.0

EMC ENGINEERS INC. EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 3/ 4/1995 10:38:23 SDL RUN 1
DENVER, CO 80227 HEATING SEASON FOR BLDG. #8069-POOL SWIMMING POOL AREA
REPORT- SS-A SYSTEM MONTHLY LOADS SUMMARY FOR POOL-H&V'S TOPEKA, KS

HRU simulation

MONTH	COOLING ENERGY (MBTU)	COOLING TIME OF MAX DY	COOLING TIME OF MAX HR	COOLING DRY-BULB TEMP	COOLING WET-BULB TEMP	MAXIMUM COOLING LOAD (KBTU/HR)	HEATING ENERGY (MBTU)	HEATING TIME OF MAX DY	HEATING TIME OF MAX HR	HEATING DRY-BULB TEMP	HEATING WET-BULB TEMP	MAXIMUM HEATING LOAD (KBTU/HR)	ELECTRICAL ENERGY (KWH)	MAXIMUM ELEC LOAD (KW)
JAN	0.00000					0.000	-127.793	15	3	-8.F	-9.F	-349.141	14645.	23.276
FEB	0.00000					0.000	-89.817	3	7	-5.F	-6.F	-312.897	13209.	23.276
MAR	0.00000					0.000	-63.658	3	8	15.F	12.F	-266.065	14685.	23.276
APR	0.00000					0.000	-16.159	5	5	31.F	29.F	-143.816	14197.	23.276
MAY	0.00000					0.000	-2.578	5	6	44.F	40.F	-88.837	7075.	23.276
OCT	0.00000					0.000	-16.335	20	8	23.F	22.F	-177.703	14598.	23.276
NOV	0.00000					0.000	-55.277	2	5	16.F	15.F	-227.738	14202.	23.276
DEC	0.00000					0.000	-114.275	12	5	4.F	3.F	-302.674	14593.	23.276
TOTAL	0.000						-485.892						107200.	
MAX						0.000						-349.141		23.276

EMC ENGINEERS INC. EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 3/ 4/1995 10:38:23 SDL RUN 1
DENVER, CO 80227 HEATING SEASON FOR BLDG. #8069-POOL SWIMMING POOL AREA
REPORT- SS-C SYSTEM MONTHLY LOAD HOURS FOR POOL-H&V'S TOPEKA, KS

D9972

MONTH	HOURS COOLING LOAD	HOURS HEATING LOAD	HOURS COINCIDENT COOL-HEAT LOAD	HOURS FLOATING	HOURS HEATING AVAIL.	HOURS COOLING AVAIL.	HOURS FANS ON	HOURS FANS CYCLE ON	HOURS NIGHT VENTING	HOURS FLOATING WHEN FANS ON	COINCIDENT LOADS: HEATING LOAD AT COOLING PEAK (KBTU/HR)	COINCIDENT LOADS: ELECTRIC LOAD AT COOLING PEAK (KW)
JAN	0	744	0	0	744	0	744	0	0	0	-132.150	14.040
FEB	0	661	0	11	672	0	672	0	0	11	-129.584	14.040
MAR	0	637	0	107	744	0	744	0	0	107	-124.141	14.040
APR	0	309	0	411	720	0	720	0	0	411	-13.589	14.040
MAY	0	82	0	278	360	0	360	0	0	278	0.000	14.040
OCT	0	360	0	384	720	0	744	0	0	384	-92.625	14.040
NOV	0	599	0	121	720	0	720	0	0	121	-174.112	14.040
DEC	0	744	0	0	744	0	744	0	0	0	-172.503	14.040
ANNUAL	0	4136	0	1312	5424	0	5448	0	0	1312		

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EMC      ENGINEERS      INC.       EZDOE - ELITE SOFTWARE DEVELOPMENT INC      DOE-2.1D   3/ 4/1995     10:38:23   SDL RUN 1
DENVER,        CO      80227       HEATING SEASON FOR BLDG. #8069-POOL      SWIMMING POOL AREA
REPORT- SS-K  SPACE TEMPERATURE SUMMARY                  POOL-H&V'S                   TOPEKA, KS
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HRU simulation

MONTH	AVERAGE SPACE TEMP: ALL HOURS (F)	COOLING HOURS (F)	HEATING HOURS (F)	FAN ON HOURS (F)	FAN OFF HOURS (F)	AVERAGE TEMPERATURE DIFFERENCE BETWEEN OUTDOOR& ROOM AIR ALL HOURS (F)	BETWEEN OUTDOOR& ROOM AIR FAN ON HOURS (F)	BETWEEN OUTDOOR& ROOM AIR FAN OFF HOURS (F)	SUMMED TEMP DIFFERENCE BETWEEN OUTDOOR& ROOM AIR HEATING HOURS (F)	BETWEEN OUTDOOR& ROOM AIR ALL HOURS (F)	HUMIDITY RATIO DIFFERENCE BETWEEN OUTDOOR AND ROOM AIR (FRAC.OR MULT.)
JAN	69.64		69.64	69.64	0.00	-43.83	-43.83	0.00	1358.63	1358.63	-0.00444
FEB	70.76		70.69	70.76	0.00	-39.07	-39.07	0.00	1085.71	1094.10	-0.00445
MAR	72.34		71.77	72.34	0.00	-32.06	-32.06	0.00	916.47	993.94	-0.00445
APR	75.79		73.38	75.79	0.00	-19.02	-19.02	0.00	330.68	570.62	-0.00448
MAY	78.58		73.85	78.58	0.00	-15.86	-15.86	0.00	80.23	237.97	-0.00464
OCT	75.26		73.33	75.26	0.00	-17.37	-17.37	0.00	351.87	538.60	-0.00451
NOV	72.47		71.88	72.47	0.00	-28.36	-28.36	0.00	788.88	850.81	-0.00453
DEC	69.97		69.97	69.97	0.00	-39.93	-39.93	0.00	1237.81	1237.81	-0.00441
ANNUAL	72.74	0.00	71.20	72.74	0.00	-30.32	-30.32	0.00	6150.28	6882.47	-0.00448

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EMC      ENGINEERS      INC.       EZDOE - ELITE SOFTWARE DEVELOPMENT INC      DOE-2.1D   3/ 4/1995     10:38:23   SDL RUN 1
DENVER,        CO      80227       HEATING SEASON FOR BLDG. #8069-POOL      SWIMMING POOL AREA
REPORT- SS-N  RELATIVE HUMIDITY SCATTER PLOT FOR         POOL-H&V'S                   TOPEKA, KS
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D9-73

TOTAL HOURS AT RELATIVE HUMIDITY LEVEL AND TIME OF DAY

HOUR	1AM	2	3	4	5	6	7	8	9	10	11	12	1PM	2	3	4	5	6	7	8	9	10	11	12	TOTAL
81-100	6	6	6	5	7	9	9	9	10	7	7	5	6	4	4	5	4	4	4	5	8	7	5	7	149
71-80	16	14	13	16	13	13	15	18	13	18	11	12	11	10	7	7	9	10	16	17	16	17	17	13	322
61-70	20	23	24	24	33	32	26	26	29	18	22	23	18	15	14	12	12	18	12	14	15	18	19	24	491
51-60	44	40	43	36	35	33	42	34	35	43	40	35	37	41	41	38	43	41	50	47	49	45	41	39	972
41-50	83	83	78	88	77	83	81	88	88	85	93	92	91	88	80	86	80	86	86	88	79	80	80	81	2024
31-40	58	61	63	58	62	57	54	52	52	56	54	60	63	69	81	79	79	68	59	56	60	60	65	63	1489
0-30	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1

EMC ENGINEERS INC. | EZDOE - ELITE SOFTWARE DEVELOPMENT INC | DOE-2.1D 3/ 4/1995 10:38:23 SDL RUN 1
DENVER, CO 80227 | HEATING SEASON FOR BLDG. #8069-POOL | SWIMMING POOL AREA
REPORT- SS-O TEMPERATURE SCATTER PLOT | POOL-H&V'S HRU simulation FOR pool-area | TOPEKA, KS

TOTAL HOURS AT TEMPERATURE LEVEL AND TIME OF DAY

HOUR	1AM	2	3	4	5	6	7	8	9	10	11	12	1PM	2	3	4	5	6	7	8	9	10	11	12	TOTAL
ABOVE 85	0	0	0	0	0	0	0	0	0	1	3	6	8	12	13	14	13	11	7	3	1	0	0	0	92
81-85	1	0	0	0	0	0	0	1	4	7	10	10	11	13	24	21	21	14	10	11	10	4	1	1	174
76-80	19	17	14	11	16	13	16	22	31	45	54	55	60	60	55	61	59	62	57	51	48	38	32	25	921
71-75	142	135	126	117	108	125	113	118	133	131	126	124	118	120	117	116	116	118	132	137	135	153	141	138	3039
66-70	64	73	85	97	101	88	97	85	59	43	34	32	30	22	18	15	18	22	21	25	33	32	53	63	1210
61-65	0	1	1	1	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5
BELOW 60	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7

EMC ENGINEERS INC. | EZDOE - ELITE SOFTWARE DEVELOPMENT INC | DOE-2.1D 3/ 4/1995 10:38:23 PDL RUN 1
DENVER, CO 80227 | HEATING SEASON FOR BLDG. #8069-POOL | SWIMMING POOL AREA
REPORT- PV-A EQUIPMENT SIZES | TOPEKA, KS

E Q U I P M E N T	SIZE (MBTU/H)	NUMBER INSTD	NUMBER AVAIL	SIZE (MBTU/H)	NUMBER INSTD	NUMBER AVAIL	SIZE (MBTU/H)	NUMBER INSTD	NUMBER AVAIL	SIZE (MBTU/H)	NUMBER INSTD	NUMBER AVAIL	SIZE (MBTU/H)	NUMBER INSTD	NUMBER AVAIL	SIZE (MBTU/H)	NUMBER INSTD	NUMBER AVAIL
HW-BOILER	0.352	1	1															

D9-74

EMC ENGINEERS INC. | EZDOE - ELITE SOFTWARE DEVELOPMENT INC | DOE-2.1D 3/ 4/1995 10:38:23 PDL RUN 1
DENVER, CO 80227 | HEATING SEASON FOR BLDG. #8069-POOL | SWIMMING POOL AREA
REPORT- PV-B COST REFERENCE DATA (USED FOR DEFAULT COSTS) | TOPEKA, KS

E Q U I P M E N T	SIZE (MBTU)	UNIT COST (K$)	INSTALD COST FACTOR	CONSUM-ABLES ($/HR)	MAINTA-NANCE (HRS/YR)	EQPMT LIFE (HRS)	HOURS ALREADY USED	HRS TO MINOR OVHAUL	MINOR OVHAUL COST ($)	HRS TO MAJOR OVHAUL	MAJOR OVHAUL COST ($)
HW-BOILER	40.000	300.000	1.400	0.000	8.0	220000.	0.	10000.	2000.	50000.	25000.

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EMC        ENGINEERS      INC.        EZDOE - ELITE SOFTWARE DEVELOPMENT INC        DOE-2.1D    3/ 4/1995      10:38:23  PDL RUN 1
  DENVER,        CO       80227       HEATING SEASON FOR BLDG. #8069-POOL      SWIMMING POOL AREA
REPORT- PS-B  MONTHLY PEAK AND TOTAL ENERGY USE                                      TOPEKA, KS
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HRU simulation

MO	UTILITY-	ELECTRICITY	NATURAL-GAS
	TOTAL(MBTU)	56.458	179.603
JAN	PEAK(KBTU)	88.459	439.382
	DY/HR	31/22	15/ 3
	TOTAL(MBTU)	50.736	132.244
FEB	PEAK(KBTU)	88.459	401.044
	DY/HR	28/22	3/ 7
	TOTAL(MBTU)	54.838	96.826
MAR	PEAK(KBTU)	88.459	350.408
	DY/HR	31/22	3/ 8
	TOTAL(MBTU)	50.171	26.704
APR	PEAK(KBTU)	88.459	212.395
	DY/HR	15/ 8	5/ 5
	TOTAL(MBTU)	24.504	4.527
MAY	PEAK(KBTU)	85.768	147.578
	DY/HR	9/ 6	5/ 6
	TOTAL(MBTU)	51.705	27.557
OCT	PEAK(KBTU)	88.459	251.497
	DY/HR	31/ 9	20/ 8
	TOTAL(MBTU)	52.812	85.255
NOV	PEAK(KBTU)	88.459	308.047
	DY/HR	30/22	2/ 5
	TOTAL(MBTU)	56.181	163.947
DEC	PEAK(KBTU)	88.459	390.097
	DY/HR	31/20	12/ 5
	ONE YEAR	397.406	716.664
	USE/PEAK	88.459	439.382


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EMC        ENGINEERS      INC.        EZDOE - ELITE SOFTWARE DEVELOPMENT INC        DOE-2.1D    3/ 4/1995      10:38:23  PDL RUN 1
  DENVER,        CO       80227       HEATING SEASON FOR BLDG. #8069-POOL      SWIMMING POOL AREA
REPORT- PS-D  PLANT LOADS SATISFIED                                                  TOPEKA, KS
```

HEATING LOADS	MBTU SUPPLIED	PCT OF TOTAL LOAD
HW-BOILER	495.7	100.0
LOAD SATISFIED	495.7	100.0
TOTAL LOAD ON PLANT	495.7	

ELECTRICAL LOADS	MBTU SUPPLIED	PCT OF TOTAL LOAD
ELECTRICITY	397.4	100.0
LOAD SATISFIED	397.4	100.0
TOTAL LOAD ON PLANT	397.4	

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EMC       ENGINEERS      INC.       EZDOE - ELITE SOFTWARE DEVELOPMENT INC        DOE-2.1D   3/ 4/1995     10:38:23  PDL RUN 1
DENVER,        CO        80227      HEATING SEASON FOR BLDG. #8069-POOL      SWIMMING POOL AREA
REPORT- PS-D  PLANT LOADS SATISFIED                                                 TOPEKA, KS
```

HRU simulation

SUMMARY OF LOADS MET

TYPE OF LOAD	TOTAL LOAD (MBTU)	LOAD SATISFIED (MBTU)	TOTAL OVERLOAD (MBTU)	PEAK OVERLOAD (MBTU)	HOURS OVERLOADED
HEATING LOADS	495.7	495.7	0.000	0.000	0
ELECTRICAL LOADS	397.4	397.4	0.000	0.000	0

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EMC       ENGINEERS      INC.       EZDOE - ELITE SOFTWARE DEVELOPMENT INC        DOE-2.1D   3/ 4/1995     10:38:23  PDL RUN 1
DENVER,        CO        80227      HEATING SEASON FOR BLDG. #8069-POOL      SWIMMING POOL AREA
REPORT- BEPS  ESTIMATED BUILDING ENERGY PERFORMANCE                                 TOPEKA, KS
```

ENERGY TYPE IN SITE MBTU - CATEGORY OF USE	ELECTRICITY	NATURAL-GAS
SPACE HEAT	26.19	716.66
SPACE COOL	0.00	0.00
HVAC AUX	266.34	0.00
DOM HOT WTR	0.00	0.00
AUX SOLAR	0.00	0.00
LIGHTS	104.87	0.00
VERT TRANS	0.00	0.00
MISC EQUIP	0.00	0.00
TOTAL	397.40	716.66

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TOTAL SITE ENERGY      1114.07 MBTU    168.8 KBTU/SQFT-YR GROSS-AREA     168.8 KBTU/SQFT-YR NET-AREA
TOTAL SOURCE ENERGY    1910.08 MBTU    289.4 KBTU/SQFT-YR GROSS-AREA     289.4 KBTU/SQFT-YR NET-AREA
PERCENT OF HOURS ANY SYSTEM ZONE OUTSIDE OF THROTTLING RANGE =  0.1
PERCENT OF HOURS ANY PLANT LOAD NOT SATISFIED                =  0.0
NOTE  ELECTRICITY AND/OR FUEL USED TO GENERATE ELECTRICITY IS APPORTIONED BASED
      ON THE YEARLY DEMAND.  ALL OTHER ENERGY TYPES ARE APPORTIONED HOURLY.
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Des Champs Laboratories Incorporated (DLI)

continuing commitment

Since 1974, Des Champs Laboratories Incorporated (DLI) has been a dominant leader in the design and manufacture of plate type air-to-air heat exchangers and packaged recovery systems. DLI has maintained that position through proven reliability with over 10,000 successful installations in every industry, from residential to commercial and including process applications. Our valued reputation for innovative engineering and quality control assures you of a superior heat recovery package capable of meeting the most demanding applications.

In addition to our in-house applications engineers, DLI is complemented by a full field service organization, as well as 50 manufacturer representative organizations; experts themselves in the energy recovery market.

Energy recovery is our business...our only business.

Industrial and commercial heat exchangers and packaged systems are manufactured at the 44,000 square foot facility in East Hanover, NJ. Also located here are the Administration, Engineering, Sales, Service, and Purchasing Departments.

Z PACK Packaged Energy Recovery System

The Z-PACK System is engineered to accommodate a wide range of industrial and HVAC energy recovery applications. The complete integration of a Z-DUCT heat exchanger, fans, and controls provide pre-engineered systems, efficient space utilization, reduce overall costs and maximize energy recovery.

Z PACK Systems provide advantages such as:

- **ETL Listed**
- **Single source responsibility**
- **Complete factory testing prior to shipment**
- **Reduction of overall installed costs**
- **Efficient space utilization by pre-design**
- **Years of experience in designing complete systems with energy recovery**
- **Computerized design to solve energy recovery problems**
- **Wide range of models**
- **Host of options**

Manufacture of the high temperature heat exchanger matrix, using state-of-the art machinery developed by Des Champs Laboratories, takes place in the Livingston, NJ facility. Also located here is the Residential heat exchanger department, the expanded Research & Development Department, Marketing, Full Service Advertising/Graphics Department, and Accounting.

Z PACK® for total environmental control

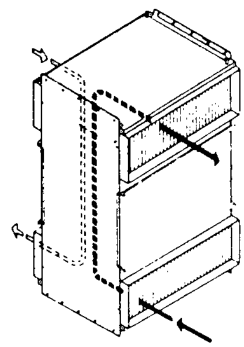
Z PACK features the unique Z-DUCT® heat exchanger

Z-DUCT is a plate type air-to-air heat exchanger. Its purpose is to transfer the thermal energy in the hot exhaust airstreams to the incoming fresh airstreams.

Counterflow airstreams are brought into close proximity, separated by one continuous, dimpled and folded, sheet of aluminum which acts as a primary heat transfer surface. This heat transfer surface is configured to form a matrix with two completely separate and distinct air passages, virtually eliminating cross-contamination. This transfer of energy from exhaust to intake air can result in a substantial energy savings.

Z-DUCT heat exchangers are highly efficient and have an effectiveness of 65-85%.

Air-to-Air Heat Recovery
Modules to Complete Engineered Packages



Z DUCT®

Customized Specialization

Z PACK offers maximum year-round energy savings

There are three modes of energy recovery that Z-DUCT can provide:

1. In winter, Z-PACK energy recovery systems recover thermal energy, previously exhausted to atmosphere, to preheat fresh incoming ventilation or make-up air.
2 In summer, an indirect evaporative cooling process transfers sensible and latent energy from the hot fresh air to the cool exhaust air, thereby cooling the fresh air.
3. In process-to-process applications, the energy from process exhaust can be used to preheat process air on a year-round basis.

Z PACK is compact and reliable

The unique Z-DUCT heat exchanger, supply and exhaust fans, and all related controls are built into a single package for indoor or outdoor mounting. The sheet metal housing is a panellized design that provides separate air plenums for intake and exhaust air. It is coated with a corrosion resistant paint, insulated and weatherproofed. All joints are sealed and/or capped to prevent leakage. The fully hinged doors provide access for the inspection and maintenance of all serviceable components.

Z PACK is designed to accommodate optional equipment

Z-PACK offers the options necessary to meet the needs of most energy recovery and make-up air applications. Design flexibility assures effective energy recovery system performance on every application.

Z PACK provides substantial benefits to the user

Most applications have a 1 to 3 year payback period. In addition to conserving valuable energy and saving dollars, productivity can also be increased in specific applications.

PKS Series

PKS SERIES 4 - 6 - 8 - 10

Applications

The PKS Series is recommended when high temperature exhausts or dirty airstreams are present. The PKS Series houses a Series 75 heat exchanger. It is equipped with a single width, single inlet exhaust fan that provides safe operation with hot or fume laden air. One of the standard design features includes an inlet plenum which was designed to satisfy the intent of NFPA96. Also, an optional safeguard against overheating has been designed for this system. (Refer to Page 17, Code 730 for complete information on design option). Some typical applications include:

- fast food fryers
- chemical fumes
- sewerage treatment plants
- drying or curing ovens
- laboratory hoods
- process exhausts

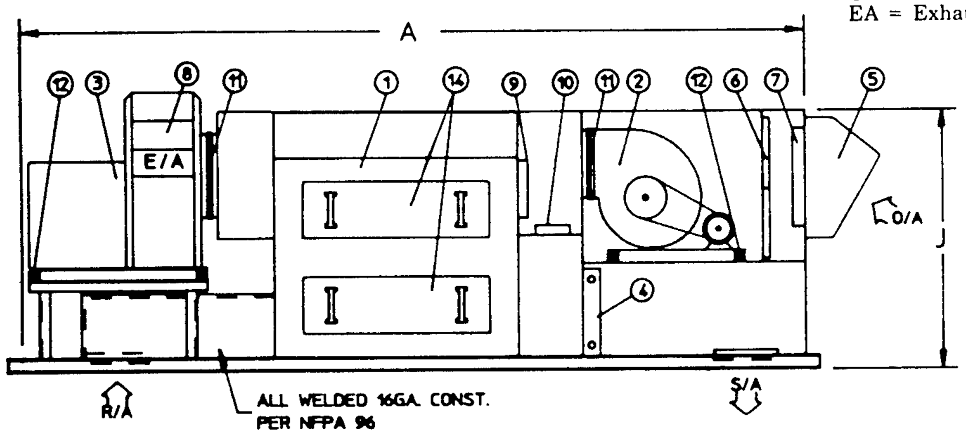
***PKS 2 and 3 available-consult factory**

Legend

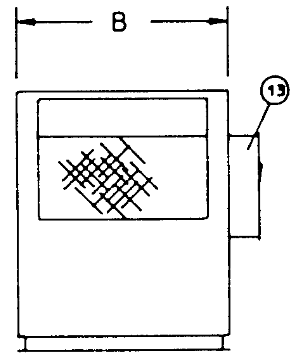
1. Z-DUCT Series 75 Heat Exchanger
2. Supply Fan W/Motor & Drives
3. Exhaust Fan W/Motor & Drives
*4. Heating and/or Cooling Coil (Optional)
5. O/A Hood W/Bird Screen
6. Supply Filters
7. O/A Damper (Optional)
8. E/A B/D Gravity Damper (Optional)
9. O/A Face Damper (Optional)
10. O/A Bypass Damper (Optional)
11. Flex Duct Connection
12. Spring Type Isolators
13. Combination Disconnect & Control Panel
14. Heat Exchanger Access Doors
15. E/A Control Damper (Optional)
16. Recirculation Damper (Optional)

***For cooling coils in PKS Series-consult factory**

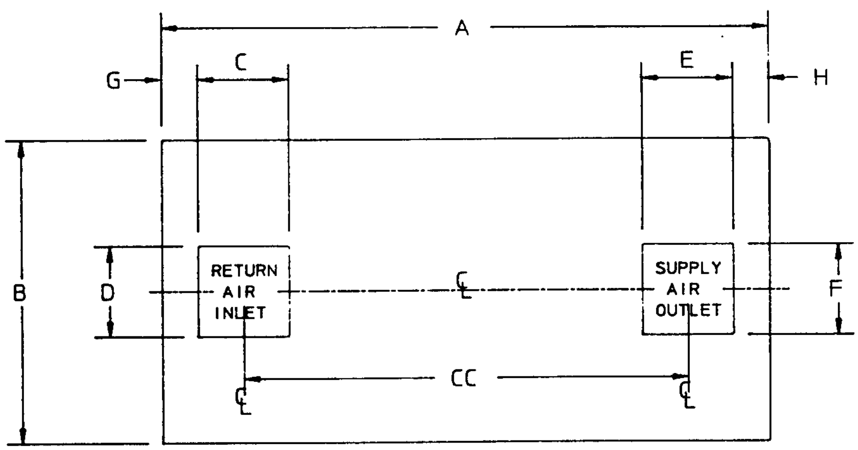
SA = Supply Air
RA = Return Air
OA = Outside Air
EA = Exhaust Air



SIDE ELEVATION



END VIEW



BOTTOM DUCT CONNECTION DETAIL

MODEL	DIMENSIONS (in inches)										SUPPLY FAN	EXHAUST FAN	WEIGHT	NOMINAL RATING
NO.	A	B	C	D	E	F	G	H	J	CC	SIZE (BI) DWDI	SIZE (BI) SWSI	LBS.	SCFM
PKS4	172¼	60	18	24	18	24	16	6	73¼	132¼	15	20	3,630	4,000
PKS6	221¾	60	18	36	18	36	18	8	73¼	177¾	18	22	4,400	6,000
PKS8	252¾	60	24	36	24	36	20	8	95	200¾	20	27	5,225	8,000
PKS10	299	72	24	48	24	48	20	8	100	247	22	30	6,050	10,000

Refer to page 11 for important notes concerning the above table.

LIFE CYCLE COST ANALYSIS SUMMARY
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

LOCATION:	Fort Riley	REGION: 2 (Kansas)		PROJECT NO:	1406-005
PROJECT TITLE:	Feasibility Study for HVAC Upgrade			FISCAL YEAR:	1995
ANALYSIS DATE:	05/04/95	ECONOMIC LIFE:	20	PREPARED BY:	C. Wohlert

1. INVESTMENT: **BLDG 8069 - Replace H&V Units with Pool Dehumidification / Pool Heating Unit**

A.	CONSTRUCTION COST	=	$181,320	
B.	SIOH COST	(5.5% of 1A) =	$9,973	
C.	DESIGN COST	(6.0% of 1A) =	$10,879	
D.	TOTAL COST	(1A +1B +1C) =	$202,172	
E.	SALVAGE VALUE OF EXISTING EQUIPMENT =		$0	
F.	PUBLIC UTILITY COMPANY REBATE =		$0	
G.	TOTAL INVESTMENT	(1D -1E -1F) =	------->	$202,172

2. ENERGY SAVINGS (+) OR COST (-):

DATE OF NISTR 85-3273-9 USED FOR DISCOUNT FACTORS: JAN '95

	ENERGY SOURCE	FUEL COST $/MBTU (1)	SAVINGS MBTU/YR (2)	ANNUAL $ SAVINGS (3)	DISCOUNT FACTOR (4)	DISCOUNTED SAVINGS (5)	
A.	ELECT.	$12.10	(559)	($6,769)	15.88	($107,488)	
B.	DIST	$0.00	0	$0	19.16	$0	
C.	NAT GAS	$4.12	3,223	$13,277	18.30	$242,964	
D.	COAL	$0.00	0	$0	16.62	$0	
E.	ELEC. DEMAND			$0	14.88	$0	
F.	TOTAL		2,663	$6,508		-------->	$135,476

3. NON-ENERGY SAVINGS (+) OR COST (-)

A. ANNUAL RECURRING (+/-)

1 ANNUAL MAINTENANCE	$0	14.88	$0
2	$0	14.88	$0
3	$0	14.88	$0
4 TOTAL ANNUAL DISC. SAVINGS (+) / COST	$0		$0

B. NON-RECURRING (+/-)

ITEM	SAVINGS (+) COST(-) (1)	YEAR OF OCCURRENCE (2)	DISCOUNT FACTOR (3) (TABLE A-2)	DISCOUNTED SAVINGS/COST (4)
a. BASELINE EQUIP. REPLCMNT.	$35,706	5	0.863	$30,814
b.				$0
c.				$0
d.				$0
e.				$0
f. TOTAL	$35,706			$30,814

C. TOTAL NON-ENERGY DISCOUNTED SAVINGS (+) OR COST (-) (3A4 + 3Bf4) = $30,814

4.	FIRST YEAR DOLLAR SAVINGS (+) / COSTS (-)	(2F3+3A4+(3Bf1/Economic Life))	$8,293
5.	SIMPLE PAYBACK (SPB) IN YEARS (MUST BE < 10 YEARS TO QUALIFY)	(1G/4) =	24.38
6.	TOTAL NET DISCOUNTED SAVINGS	(2F5 + 3C) =	$166,290
7.	DISCOUNTED SAVINGS-TO-INVESTMENT RATIO (SIR) (MUST HAVE SIR > 1.25 TO QUALIFY)	(6/1G) =	0.82

ENGINEER'S OPINION OF PROBABLE COST

PROJECT	Fort Riley Feasibility Study for HVAC Upgrade	**SHEET**	1 OF 1
ENGINEER	E M C Engineers, Inc.	**DATE PREPARED**	4-May-95
	Denver, CO	**ESTIMATOR**	C. Wohlert
		CHECKED BY	A. Niemeyer

Line No.	Item Refer Code	Item Description	Unit of Measure	MATERIAL COST Quantity	MATERIAL COST Unit Cost	MATERIAL COST Total	LABOR COST Crew/ Worker	LABOR COST Hours/ Unit	LABOR COST Total	TOTAL
1		**BUILDING 8069**								
2		**PROPOSED SYSTEM MODIFICATIONS**								
3										
4		*NEW SYSTEMS INSTALLATION*								
5		Martini 2012	EA.	2.0	$49,600.00	$99,200	Q-6	40	$1,608	$100,808
6	STLPIP4	STEEL PIPE SCH. 40, 4" W/HANGERS	L.F.	200.0	$9.16	$1,831	Q-15	0.432	$1,675	$3,507
		FITTINGS, 5%				$92			$84	$175
7	INSLPIP4	4" FIBERGLASS PIPE INSULATION, 1.5" THCK	L.F.	200.0	$1.89	$378	Q-14	0.114	$420	$798
8	STLPIP3	STEEL PIPE SCH. 40, 3" W/HANGERS	L.F.	100.0	$6.40	$640	Q-15	0.372	$721	$1,361
		FITTINGS, 5%				$32			$36	$68
9	INSLPIP3	3" FIBERGLASS PIPE INSULATION, 1.5" THCK	L.F.	100.0	$1.66	$166	Q-14	0.094	$173	$339
10	PMP5HP	PUMP, 5 HP	EA	2.0	$1,114.35	$2,229	Q-1	8.889	$345	$2,573
11	DUCT500	GAL. STEEL DUCTWORK, 200 TO 500 LB.	LB.	1260.0	$0.47	$586	Q-10	0.098	$2,399	$2,985
12	ELCND1	ELECTRICAL CONDUIT 1"	L.F.	50.0	$0.83	$42	1-ELEC	0.064	$67	$109
13	WIRE#6	COPPER WIRING #6	C.L.F.	1.0	$24.71	$25	1-ELEC	1.231	$26	$50
14	ROFEXH15	ALUMINUM GALV. ROOF INTAKE, 15,000 CFM	EA.	1.0	$2,616.30	$2,616	Q-9	12.3	$231	$2,847
15	E-TSTAT1	SINGLE SETPOINT ELEC. TSTAT, 3 WIRE	EA.	1.0	$24.23	$24	1-ELEC	0.8	$17	$41
16	WIRE#12	COPPER WIRING #12	C.L.F.	1.0	$7.41	$7	1-ELEC	0.727	$15	$23
17		ROOF PENETRATION	EA.	2.0			Q-5	14	$543	$543
18										
19										
20										
21										
22										
23										
24										
25		*EXISTING SYSTEMS DEMOLITION*								
26		AHU DEMO	TON	4.0			Q-5	17.778	$1,379	$1,379
#REF!										
#REF!										
#REF!		**SUBTOTAL**				$107,867			$9,739	$117,606
#REF!	OH	OVERHEAD			17%	$18,122			$1,636	$19,758
#REF!	PRO	PROFIT			10%	$12,599			$1,137	$13,736
#REF!	CONT	CONTINGENCY			20%	$27,718			$2,502	$30,220
#REF!	**TOTAL COST**		-	-	-	$166,305	-	-	$15,015	$181,320

ENGINEER'S OPINION OF PROBABLE COST

PROJECT	Fort Riley Feasibility Study for HVAC Upgrade	**SHEET**	1 OF 1
ENGINEER	E M C Engineers, Inc.	**DATE PREPARED**	4-May-95
	Denver, CO	**ESTIMATOR**	C. Wohlert
		CHECKED BY	A. Niemeyer

Line No.	Item Refer Code	Item Description	Unit of Measure	MATERIAL COST Quantity	MATERIAL COST Unit Cost	MATERIAL COST Total	LABOR COST Crew/ Worker	LABOR COST Hours/ Unit	LABOR COST Total	TOTAL
1		**BUILDING 8069**								
2		**NON-RECURRING**								
3										
4		*EXISTING SYSTEM REPLACEMENT*								
5	AHU5400	5,400 CFM AHU, HEATING ONLY	EA.	4.0	$3,803.33	$15,213	Q-6	30	$2,413	$17,626
6	DUCT500	GAL. STEEL DUCTWORK, 200 TO 500 LB.	LB.	500.0	$0.47	$233	Q-10	0.098	$952	$1,185
7	STLPIP1.25	STEEL PIPE SCH. 40, 1.25" W/HANGERS	L.F.	120.0	$2.56	$307	Q-1	0.2	$465	$772
8		FITTINGS ADD 5%				$15			$23	$39
9	INSLPIP1.25	1.25" FIBERGLASS PIPE INSULATION, 1.5" THCK	L.F.	120.0	$1.40	$167	Q-14	0.08	$177	$344
10	CNTV1	CONTROL VALVE 1"	EA.	4.0	$190.89	$764	1-PLUM	0.471	$41	$804
11	E-TSTAT1	SINGLE SETPOINT ELEC. TSTAT, 3 WIRE	EA.	1.0	$24.23	$24	1-ELEC	0.8	$17	$41
12	WIRE#12	COPPER WIRING #12	C.L.F.	1.0	$7.41	$7	1-ELEC	0.727	$15	$23
13	DMP28X44	DAMPER W/ ACT, 28" X 44"	EA.	3.0	$278.10	$834	Q-9	2	$112	$947
14										
15										
16										
17										
18										
19										
20										
21										
22		*EXISTING SYSTEMS DEMOLITION*								
23		AHU DEMO	TON	4.0			Q-5	17.778	$1,379	$1,379
24										
25										
26										
27										
28										
29										
30										
31		**SUBTOTAL**				$17,565			$5,594	$23,159
32	OH	OVERHEAD			17%	$2,951			$940	$3,891
33	PRO	PROFIT			10%	$2,052			$653	$2,705
34	CONT	CONTINGENCY			20%	$4,514			$1,437	$5,951
35	**TOTAL COST**		-	-	-	$27,081	-	-	$8,625	$35,706

ENGINEER'S OPINION OF PROBABLE COST

PROJECT	Fort Riley Feasibility Study for HVAC Upgrade	**SHEET** 1	**OF** 1
ENGINEER	E M C Engineers, Inc.	**DATE PREPARED**	4-Mar-95
	Denver, CO	**ESTIMATOR**	C. Wohlert
		CHECKED BY	A. Niemeyer

Line No.	Item Refer Code	Item Description	Unit of Measure	MATERIAL COST Quantity	Unit Cost	Total	LABOR COST Crew/ Worker	Hours/ Unit	Total	TOTAL
1		**BUILDING 8069**								
2		***ANNUAL RECURRING***								
3		***ANNUAL MAINTENANCE COST - BASELINE***								
4										
5										
6										
7										
8										
9										
10										
11										
12										
13										
14										
15	**TOTAL ANNUAL MAINTENANCE COST - BASELINE**		-	-	-	$0	-	-	$0	$0
16										
17		***ANNUAL MAINTENANCE COST - NEW HVAC REPLACEMENT***								
18										
19										
20										
21										
22										
23										
24										
25										
26										
27										
28										
29	**TOTAL ANNUAL MAINTENANCE COST - BASELINE**		-	-	-	$0	-	-	$0	$0
30										
31										
32										
33										
34										
35	**TOTAL ANNUAL MAINTENANCE COST SAVINGS**		-	-	-	$0	-	-	$0	$0

MARTINI-2000 FRESH AIR INDOOR POOL DEHUMIDIFICATION
by
Des Champs Laboratories Incorporated
Box 440, East Hanover, New Jersey 07936
201-884-1460 FAX 201-884-8960

GENERAL INFORMATION

DATE ANALYSIS WAS PERFORMED:	02-22-1995
JOB NAME:	HVAC UPGRADE
JOB NUMBER:	1406-005
DLI REPRESENTATIVE:	EMC ENGINEERS
ENGINEER OR ARCHITECT:	A. J. NIEMEYER
ANALYSIS PREPARED BY:	A. J. NIEMEYER
ACTUAL SITE LOCATION:	FT. RILEY, KS
NEAREST SITE HAVING AVAILABLE BIN DATA:	Topeka KA
FILE NAME (STORED AS DOS FILE):	BLDG8069

INFORMATION REQUIRED TO PROPERLY SELECT MARTINI-2000

SUMMER A/C CONTROL? (Y/N):	Y
SUMMER SENSIBLE LOAD, BTU/hr: (Does Not Include Outside Air)	840000
OPTIONAL INTEGRAL POOL WATER HEATER?(Y/N):	Y
SYSTEM VOLTAGE? (120/208/460):	460
INSTALL OUTDOORS? (Y/N):	N
CURB OR SLAB? (C/S):	
SUSPEND CEILING OR FLOOR MOUNT? (S/M):	M
DESIGN RELATIVE HUMIDITY, Percent:	50-60
AIR TEMPERATURE, Degrees F:	78
POOL #1 WATER TEMPERATURE, Degrees F:	84
POOL #1 WATER AREA, Square Feet:	3444
POOL #2 WATER TEMPERATURE, Degrees F:	0
POOL #2 WATER AREA, Square Feet:	0
DECK AREA(without pool), Square Feet:	2736
ACTIVE HOURS PER DAY, Hours:	15
POOL ACTIVITY FACTOR(Private=1, Public=2):	2
AVERAGE CEILING HEIGHT OF SPACE, Feet:	24
NOTES:	BLDG 8069

INFORMATION REQUIRED TO DETERMINE OPERATING COST
ELECTRICTY = E STEAM = S OIL = O GAS = G

POOL HEATED WITH? (E/S/O/G):	S
OUTSIDE AIR HEATED WITH? (E/S/O/G):	S
ELECTRICITY COST, $/KwHr.:	.0413
STEAM COST, $/1000 Pounds	4.33
OIL COST, $/Gallon	0
GAS COST, $/Therm (1 Therm = 100,000 BTU)	0

LOCAL DESIGN CONDITIONS

ALTITUDE, Feet:	877
HEATING HOURS, Hours:	6384
COOLING HOURS, Hours:	2376
WINTER DESIGN TEMPERATURE, Degrees F:	-4
SUMMER DESIGN DRY BULB TEMPERATURE, Degrees F:	99
SUMMER DESIGN WET BULB TEMPERATURE, Degrees F:	79

MARTINI-2000 FRESH AIR INDOOR POOL DEHUMIDIFICATION
by
Des Champs Laboratories Incorporated
File Name: BLDG8069 Job Name: HVAC UPGRADE

THERMODYNAMIC CONDITIONS WITHIN POOL ENCLOSURE

INACTIVE PERIOD POOL EVAPORATION:	
Pool No.1 Water Evaporation Rate, Lbs/hr:..............	100.60
Pool No.2 Water Evaporation Rate, Lbs/hr:..............	0.00
Total Hourly Evaporation Rate, Lbs/hr:...............	100.60
Inactive Hours Daily:..................................	9.00
Inactive Daily Evaporation Rate, Lbs/day:..............	905.39
ACTIVE PERIOD POOL EVAPORATION USING 2 ACTIVITY FACTOR:	
Pool No.1 Water Evaporation Rate, Lbs/hr:..............	201.20
Pool No.2 Water Evaporation Rate, Lbs/hr:..............	0.00
Total Hourly Evaporation Rate, Lbs/hr:...............	201.20
Hours Daily:...	15.00
Active Daily Evaporation Rate, Lbs/day:................	3,017.96
TOTAL OF ACTIVE AND INACTIVE DAILY PERIODS:	
Total Daily Evaporation Rate, Lbs/day:.................	3,923.35
Average Hourly Evaporation Rate, Lbs/hr:...............	163.47
Total Make-Up Water Required, Gallons/day:.............	470.43
AIR FLOW, CFM, DELIVERED TO THE POOL ENCLOSURE FOR:	
4 Air Changes/hr(Winter Design>10F with No Spectators):	9,888.00
6 Air Changes/hr(Most Climates with Some Spectators):..	14,832.00
8 Air Changes/hr(Winter Design<10F with Spectators):...	19,776.00
ASHRAE Recommended Minimum Outside Air(0.5 CFM/SqFt):..	3,090.00

CALCULATED TEMPERATURE CONDITIONS WITHIN POOL ENCLOSURE:

Pool Air Dew Point Temperature at 60 % R.H, Degrees F: 63.05

Approximate Inside Wall Temperature on Design Winter Day, F

Inside Film Coefficient BTU/(hr SqFt F)	Thermal Resistance, R, (hr SqFt F)/BTU 2	3	15	20	25
0.90 (still air)	<u>32.44</u>	<u>47.63</u>	71.93	73.44	74.36
1.50 (150 ft/min)	<u>50.67</u>	<u>59.78</u>	74.36	75.27	75.81
3.00 (500 ft/min)	<u>64.33</u>	68.89	76.18	76.63	76.91

In the above table, the 'R' value of 2 is representative of double glazed windows and the value of 3 is representative of triple glazed. The temperatures shown underlined are below or very near the indoor dewpoint temperature, therefore condensing may occur.

MARTINI-2000 FRESH AIR INDOOR POOL DEHUMIDIFICATION
by
Des Champs Laboratories Incorporated
File Name: BLDG8069 Job Name: HVAC UPGRADE

COST TO DEHUMIDIFY, CONDITION INCOMING FRESH AIR, AND HEAT POOL WATER

Outside AirTemp,F	Hours @ Temp	CFM O.A.	Cost, $/Hour, to: Condition Air	Heat Pool	Overcome HX Press.	Total BIN Cost
		Operation During Heating Season				
-3	23	4485	0.610	1.029	0.022	38.19
2	44	4590	0.586	1.029	0.023	72.06
7	87	4588	0.547	1.029	0.023	139.11
12	141	4748	0.527	1.029	0.026	222.89
17	209	4961	0.508	1.029	0.029	327.34
22	314	5049	0.475	1.029	0.031	481.83
27	432	5397	0.462	1.029	0.038	660.37
32	615	5204	0.402	0.957	0.034	856.43
37	613	5779	0.398	0.957	0.046	858.75
42	586	6229	0.377	0.957	0.058	815.23
47	533	6880	0.358	0.957	0.078	742.39
52	601	7869	0.344	0.957	0.116	851.51
57	633	10823	0.382	0.957	0.303	1038.97
Cost to Operate During Heating Season:.................. $						7,105.08
		Operation During Cooling Season				
62	709	3090	0.433	0.000	0.239	476.36
67	805	3090	0.522	0.000	0.239	612.58
72	805	3090	0.594	0.000	0.239	670.63
77	657	3090	0.643	0.000	0.239	579.08
82	469	3090	0.677	0.000	0.239	429.35
87	269	3090	0.756	0.000	0.239	267.58
92	139	3090	0.802	0.000	0.239	144.68
97	38	3090	0.810	0.000	0.239	39.85
102	7	3090	0.819	0.000	0.239	7.40
Cost to Operate During Cooling Season:.................. $						3,227.52

Yearly Cost to Condition Air and Heat Pool Water:.........$ 10,332.60

$\$10{,}332.6 \times \frac{1\,KWH}{\$0.0413} = 250{,}184\ KWH;\ 250{,}184\ KWH \times 3413\ BTU/KW = 853{,}878{,}058\ BTU$ or 853.9 MBH

MARTINI-2000 MODEL SELECTION FOR THIS APPLICATION IS:

Model Required for Dehumidification --> 2020-ODAC-2190

The MARTINI 2020-ODAC-2190 Will Result in 8.09 Air Changes per Hour.

Model Required for: 4 Air Changes per Hour --> 2012-ODAC-1352
6 Air Changes per Hour --> 2016-ODAC-1752
8 Air Changes per Hour --> 2020-ODAC-2190

If the Model selected to give the proper dehumidification does not result in the proper air changes then please contact the factory to discuss the proper selection.

Pool Dehumidification
and
Water Heating
with
Energy Recycling

The Martini 2000, by Des Champs Laboratories, is an all season pool dehumidification unit, utilizing energy recycling to heat pool water and air at high efficiency and low operating cost. It is lower in operating cost than competitive units because only outdoor air is used to dehumidify for most of the year. No compressor is required to operate during this period.

The Martini 2000 automatically changes its operating mode as climatic conditions change with the seasons, to provide dehumidification of the pool area, utilizing the most economical operating mode for the conditions. The energy recovered in the dehumidification process is recycled to heat the pool water and heat or cool the air being supplied to the pool area. When the outside air dewpoint goes below 55°F, the Martini 2000 shuts off the mechanical dehumidification and increases the outside air for dehumidification, thereby reducing operating costs. All units incorporate the Des Champs energy recycling heat exchanger in all modes of operation to reduce operating costs. Fresh air for ventilation is introduced to the pool space in all modes of operation. Fresh air increases the life of everything in the space... including the humans.

- **Fully automatic, all season operation**
  No selection switches to manually change from season to season.

- **High efficiency**
  Recycles energy in all modes of operation to lower operating costs.

- **Dual level humidity control, automatically**
  In winter, the pool space humidity is controlled at a lower humidity than in summer operation. This insures elimination of condensation on cold walls, windows and structure, eliminates building deterioration, and reduces building maintenance.

- **Weatherproof and corrosion resistant construction**
  Can be installed indoors or outside on slabs or rooftops. Components and cabinet materials are corrosion resistant.

- **Provides optional pool water heating and supply air heating**
  Accomplished with recycled energy, when operating in the mechanical refrigeration mode, reducing operating costs.

- **Maintains negative pressure in the pool space at all times**
  Prevents pool moisture from migrating to other rooms.

- **Effective ventilation of pool space in all modes**
  Reduces chloramine odors and produces comfortable and safer conditions.

- **Nine unit sizes**
  Provide maximum flexibility to select the correct size for the application.

- **Air conditioning option available**

- **Domestic water heating option available**

- **Computer selection and economic analysis by DLI**
  Correctly selects unit size and indicates all performance.

- **Spring vibration isolated supply and return fans**

- **Disconnect switch**

- **Integral lifting lugs**

D9-91

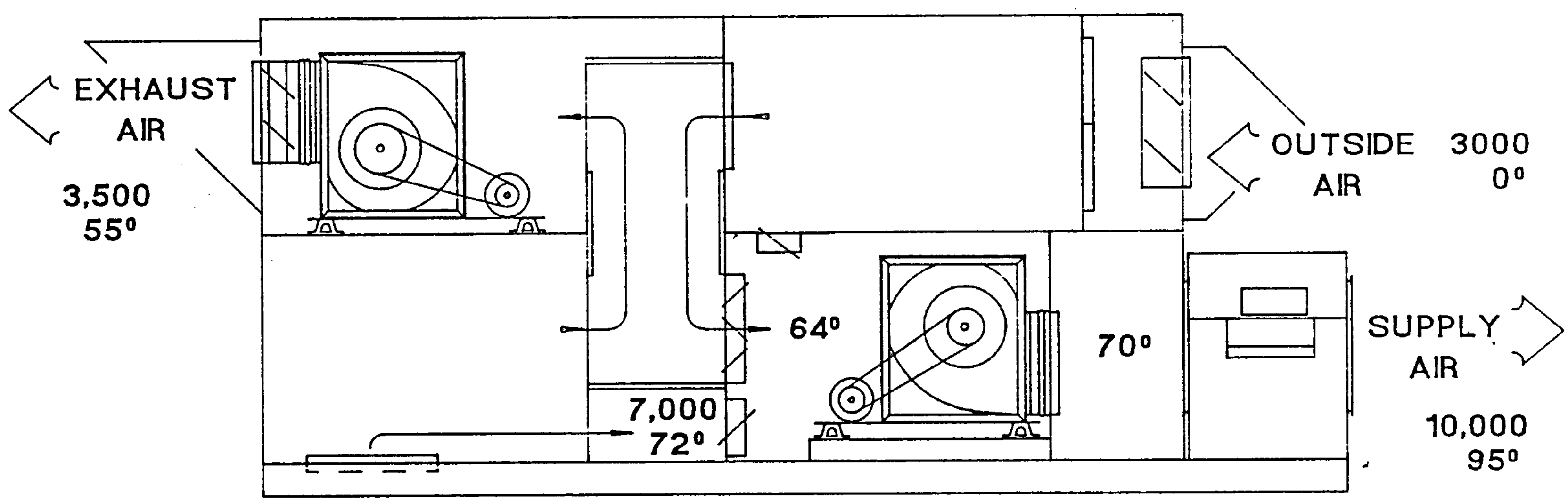
Martini 2000 Performance (Figure 3)

Martini Model		2001	2002	2003	2004	2006	2008	2012	2016	2024
Moisture Absorbtion Rate (Nominal) lbs./hr.		10	23	36	49	66	97	135	175	241
Supply Air SCFM		1000	2000	3000	4000	6000	8000	12000	16000	22000
Return Air SCFM		1100	2200	3300	4400	6600	8800	13200	17600	24200
Minimum Fresh Air SCFM		250	500	750	1000	1500	2000	3000	4000	5500
Condensing Unit Size (Nominal) Tons[1]		2	4	6	8	10	15	21	26	40
Pool Water Heater (Optional Coaxial Coil Type)	Capacity – BTU/hr.	15000	34500	54000	73500	99000	145500	202500	262500	362000
	Water Flow – GPM	3	7	11	15	20	29	40	58	87
	Pressure Drop – PSI	4.0	4.5	4.6	8.0	5.5	9.2	5.5	9.2	9.2
	Connection Size – Inch	5/8	3/4	1 1/8	1 1/8	1 1/8	1 1/8	1 5/8	1 5/8	1 5/8
Air Heating - Heat Reclaim Coil (Optional) 15°F Temperature Rise	Capacity – BTU/hr.	17000	29500	42000	54500	61000	94500	133500	153500	278000
	Air Pressure Drop – In. WC	0.22	0.27	0.27	0.31	0.29	0.28	0.27	0.30	0.30
Air Heating - Hot Water Coil (Optional) 180° EWT 160° LWT 40° Air Temperature Rise	Capacity – BTU/hr.	43400	86800	130200	173600	260400	347200	520800	694400	954800
	Air Pressure Drop – In. WC	0.17	0.23	0.26	0.26	0.24	0.21	0.21	0.23	0.23
	Water Flow – GPM	4.4	8.7	13.1	17.5	26.2	35.0	52.5	70.0	96.2
	Water Pressure Drop – In. WC	3.5	.3	.6	1.2	2.1	3.4	5.8	10.8	10.3
Air Heating - Indirect Gas Fired Heater Natural Gas or Propane (Optional)	30°F Rise BTU/hr.	N/A	55299	97650	110599	195300	221198	385000	462000	616000
	Air Pressure Drop – In. WC	—	0.11	0.49	0.45	0.38	0.47	0.38	0.47	0.68
	40°F Rise – BTU/hr.	43400	86800	130200	173600	260400	347200	520800	539000	N/A
	Air Pressure Drop – In. WC	0.10	0.24	0.26	0.29	0.26	0.29	0.26	0.36	—

[1] At 80°F, 60% RH pool space conditions and 95°/75° outdoor air temperature.

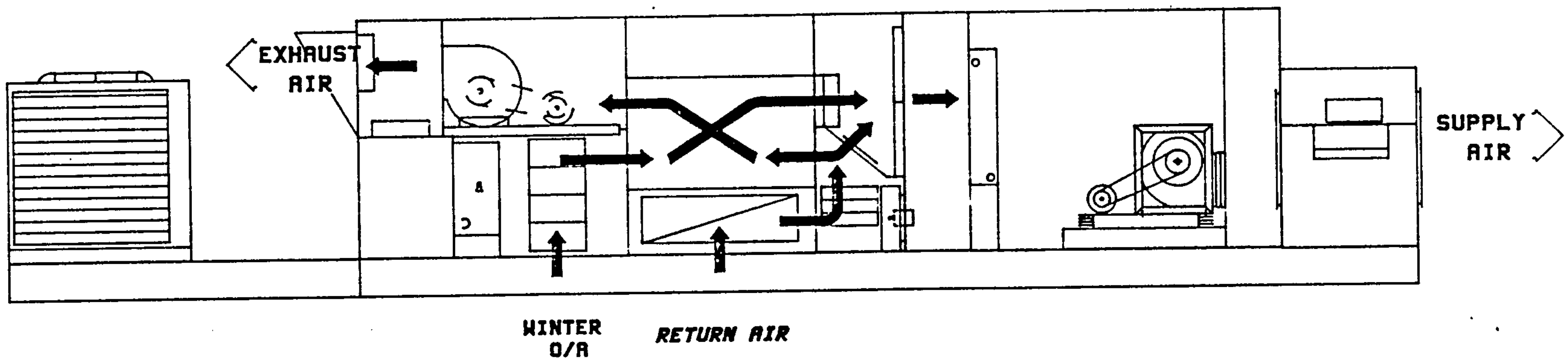
APPENDIX E

MINI Z PACK WITH 30% OUTSIDE AIR & ENERGY RECOVERY FOR TOTAL POOL VENTILATION AND DEHUMIDIFICATION



APPENDIX G

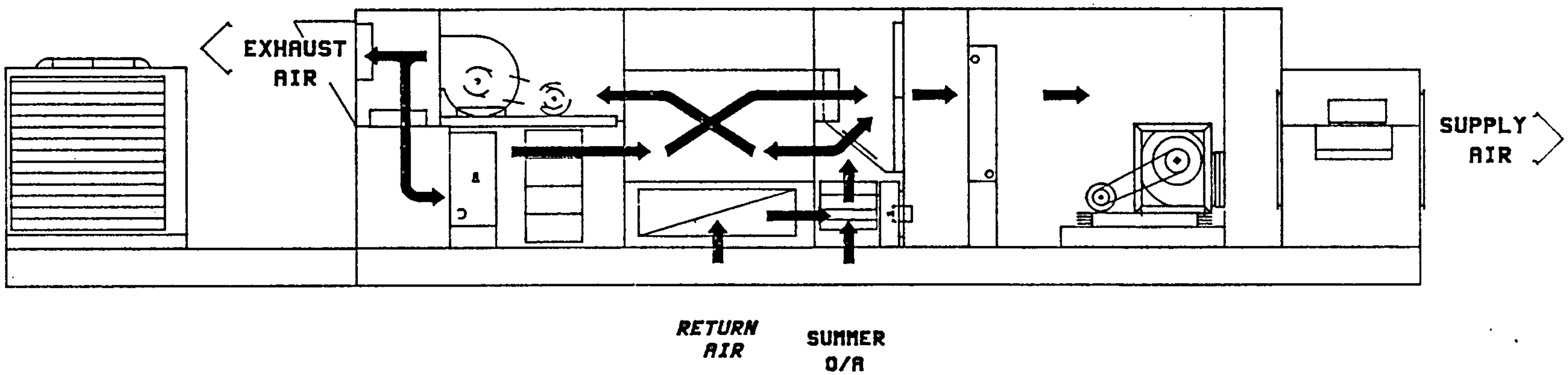
MARTINI 2000



WINTER OPERATION

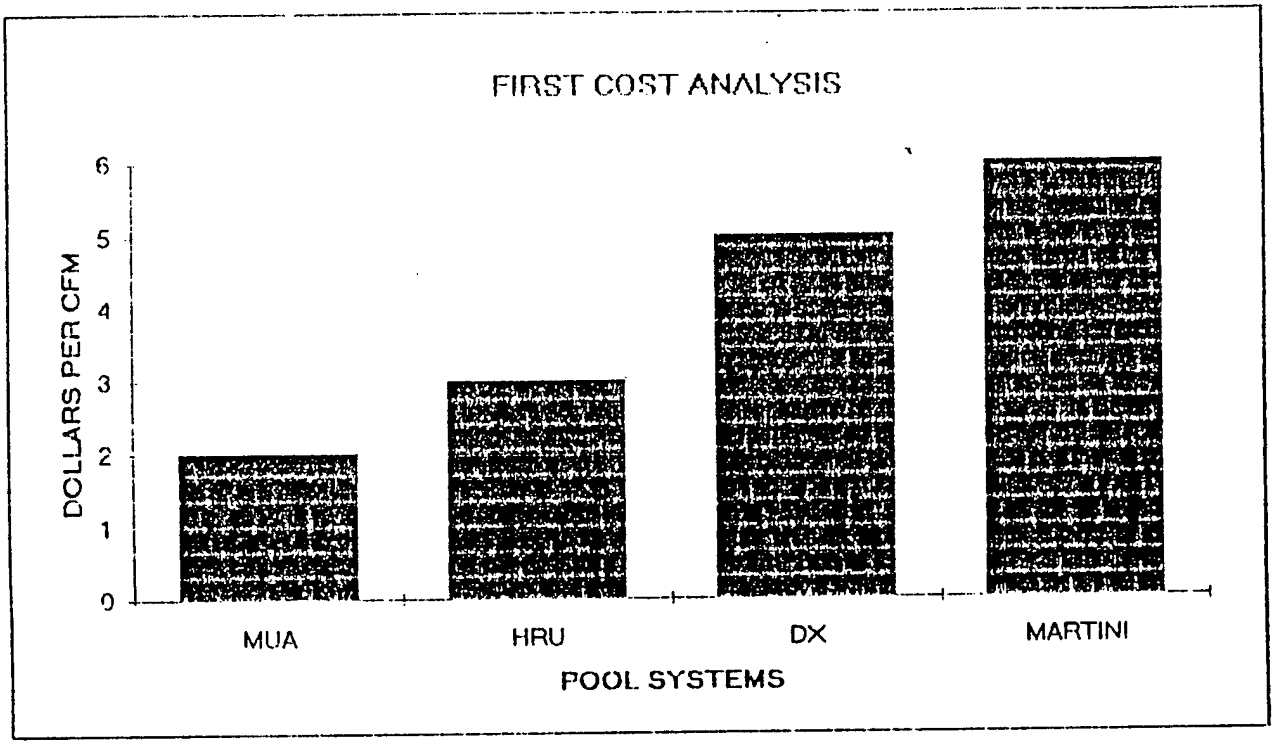
APPENDIX G

MARTINI 2000

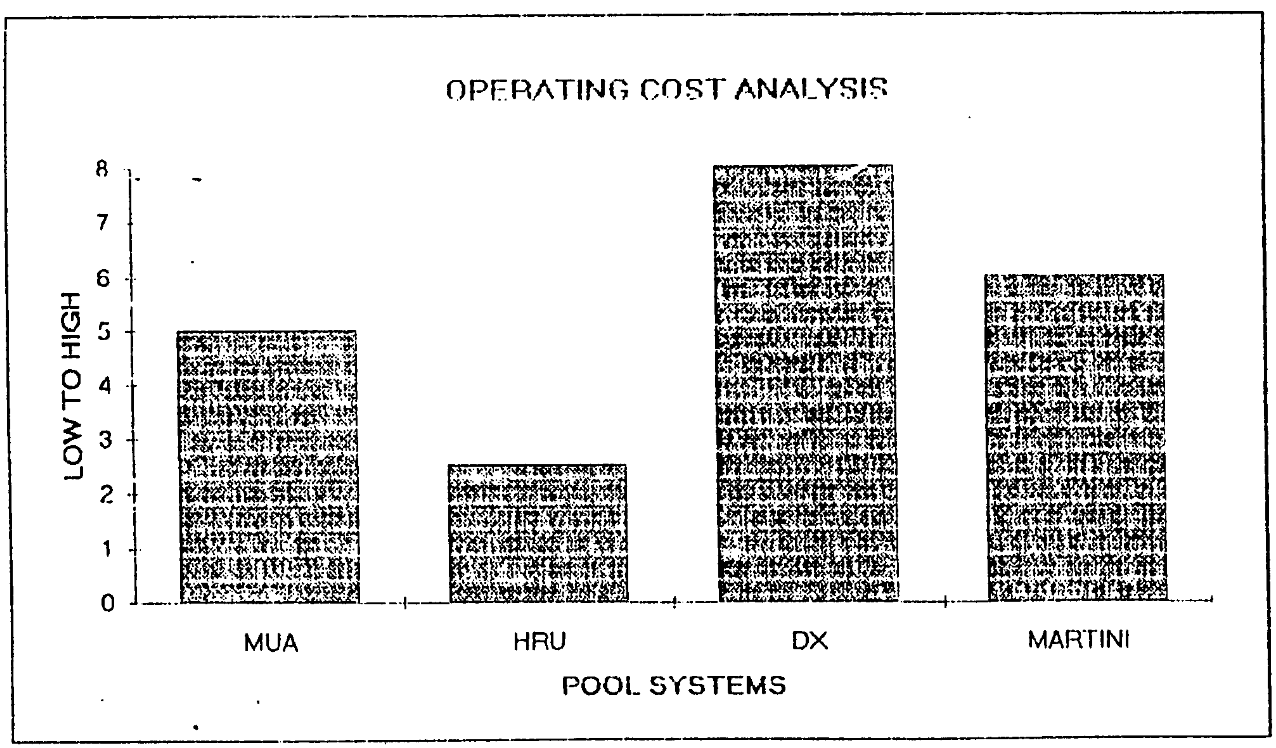


SUMMER OPERATION

APPENDIX "H"



APPENDIX "I"



CFM COMPANY

AIR CONDITIONING / HEATING / VENTILATING EQUIPMENT

2735 SOUTH RARITAN STREET
ENGLEWOOD, COLORADO 80110-1182

PHONE: 303-761-2291
TELEFAX: 303-761-0325

DATE 3/3/95

PAGE 1 OF 2
(including this sheet)

TO: Mr Allen Neumeyer
EMC Engineers
FAX 985-2527

SUBJECT: Ft Riley KS
Pool Units

REMARKS:

Allen: Enclosed is the Budget Pricing you requested

for a MZP-8704 & 3 Martini 2000 Pool Unit in FRT.

MZP-8704 ⇒ $25,323.00 = 4,500 cfm (Z-PACK UNIT)

Martini-2000 ⇒ 2012 ⇒ $49,605.00

Martini-2000 2016 ⇒ $58,820.00

Martini-2000 2024 ⇒ $72,045.00

Please call if you have any questions

for a 9,600 cfm Z Pack = MZP8710 = $43,650
24,900 cfm Z Pack = PV24 = $100,600

Thanks Jerry

☐ PLEASE REPLY

CFM 103 9/94

D9-96

BUILDING 7739
ANNUAL ENERGY SAVINGS SUMMARY

Item	Baseline	ECO	Annual Energy Savings	Adj. Annual Energy Savings*
Annual Electric (MBTU)	679.99	416.91	263.08	101.39
Annual Natural Gas (MBTU)	185.29	280.54	-95.25	-36.71
Electric Demand June (KW)	58.54	44.88	13.66	5.26
Electric Demand July (KW)	60.91	47.47	13.44	5.18
Electric Demand August (KW)	63.88	50.09	13.79	5.31

*Energy savings prorated on a square foot basis:

Baseline Model Bldg 7806 (sq.ft.)	11310
ECO Model Bldg 7739 (sq.ft.)	4359
Square Footage Adjustment Factor	0.385

LIFE CYCLE COST ANALYSIS SUMMARY

ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

LOCATION:	Fort Riley	REGION: 2 (Kansas)		PROJECT NO:	1406-005
PROJECT TITLE:	Feasibility Study for HVAC Upgrade			FISCAL YEAR:	1995
ANALYSIS DATE:	05/04/95	ECONOMIC LIFE:	20	PREPARED BY:	C. Wohlert

1. INVESTMENT: **BLDG 7739 - Replace MZ w/ VAV AHU**

A.	CONSTRUCTION COST	=	$24,649	
B.	SIOH COST	(5.5% of 1A) =	$1,356	
C.	DESIGN COST	(6.0% of 1A) =	$1,479	
D.	TOTAL COST	(1A +1B +1C) =	$27,484	
E.	SALVAGE VALUE OF EXISTING EQUIPMENT	=	$0	
F.	PUBLIC UTILITY COMPANY REBATE	=	$0	
G.	TOTAL INVESTMENT	(1D -1E -1F) =	------->	$27,484

2. ENERGY SAVINGS (+) OR COST (-):

DATE OF NISTR 85-3273-9 USED FOR DISCOUNT FACTORS: JAN '95

	ENERGY SOURCE	FUEL COST $/MBTU (1)	SAVINGS MBTU/YR (2)	ANNUAL $ SAVINGS (3)	DISCOUNT FACTOR (4)	DISCOUNTED SAVINGS (5)	
A.	ELECT.	$12.10	101	$1,227	15.88	$19,483	
B.	DIST	$0.00	0	$0	19.16	$0	
C.	NAT GAS	$4.12	(37)	($151)	18.30	($2,768)	
D.	COAL	$0.00	0	$0	16.62	$0	
E.	ELEC. DEMAND			$283	14.88	$4,211	
F.	TOTAL		65	$1,359		-------->	$20,926

3. NON-ENERGY SAVINGS (+) OR COST (-)

A. ANNUAL RECURRING (+/-)

1 ANNUAL MAINTENANCE	$0	14.88	$0
2	$0	14.88	$0
3	$0	14.88	$0
4 TOTAL ANNUAL DISC. SAVINGS (+) / COST	$0		$0

B. NON-RECURRING (+/-)

ITEM	SAVINGS (+) COST(-) (1)	YEAR OF OCCURRENCE (2)	DISCOUNT FACTOR (3) (TABLE A-2)	DISCOUNTED SAVINGS/COST (4)
a. BASELINE EQUIP. REPLCMNT.	$14,830	5	0.863	$12,798
b.				$0
c.				$0
d.				$0
e.				$0
f. TOTAL	$14,830			$12,798

C. TOTAL NON-ENERGY DISCOUNTED SAVINGS (+) OR COST (-) (3A4 + 3Bf4) = $12,798

4.	FIRST YEAR DOLLAR SAVINGS (+) / COSTS (-)	(2F3+3A4+(3Bf1/Economic Life))	$2,100
5.	SIMPLE PAYBACK (SPB) IN YEARS (MUST BE < 10 YEARS TO QUALIFY)	(1G/4) =	13.09
6.	TOTAL NET DISCOUNTED SAVINGS	(2F5 + 3C) =	$33,724
7.	DISCOUNTED SAVINGS-TO-INVESTMENT RATIO (SIR) (MUST HAVE SIR > 1.25 TO QUALIFY)	(6/1G) =	1.23

ENGINEER'S OPINION OF PROBABLE COST

PROJECT	Fort Riley Feasibility Study for HVAC Upgrade	**SHEET**	1 **OF** 1
ENGINEER	E M C Engineers, Inc.	**DATE PREPARED**	4-May-95
	Denver, CO	**ESTIMATOR**	C. Wohlert
		CHECKED BY	A. Niemeyer

Line No.	Item Refer Code	Item Description	Unit of Measure	MATERIAL COST Quantity	MATERIAL COST Unit Cost	MATERIAL COST Total	LABOR COST Crew/ Worker	LABOR COST Hours/ Unit	LABOR COST Total	TOTAL
1		**BUILDING 7739**								
2		**PROPOSED SYSTEM MODIFICATIONS**								
3										
4		*NEW SYSTEMS INSTALLATION*								
5	AHU8000	8,000 CFM AHU, COOLING ONLY	EA.	1.0	$4,433.18	$4,433	Q-6	40	$804	$5,237
6	VAVBX35	VAV BOX, 3500 CFM, ELEC	EA.	1.0	$310.08	$310	1-SHEE	1.48	$31	$341
7	VAVBX24	VAV BOX, 2400 CFM, ELEC	EA.	2.0	$287.31	$575	1-SHEE	1.33	$55	$630
8	DUCT500	GAL. STEEL DUCTWORK, 200 TO 500 LB.	LB.	650.0	$0.47	$302	Q-10	0.098	$1,238	$1,540
9	E-TSTAT1	SINGLE SETPOINT ELEC. TSTAT, 3 WIRE	EA.	3.0	$24.23	$73	1-ELEC	0.8	$50	$123
10	WIRE#12	COPPER WIRING #12	C.L.F.	2.5	$7.41	$19	1-ELEC	0.727	$38	$57
11	STLPIP2	STEEL PIPE SCH. 40, 2" W/HANGERS	L.F.	30.0	$3.91	$117	Q-1	0.25	$145	$263
12	STLPIP1	STEEL PIPE SCH. 40, 1" W/HANGERS	L.F.	180.0	$2.10	$378	Q-1	0.151	$527	$906
13		FITTINGS ADD 5%				$25			$34	$58
14	INSLPIP2	2" FIBERGLASS PIPE INSULATION, 1.5" THCK	L.F.	30.0	$1.46	$44	Q-14	0.084	$46	$90
15	INSLPIP1	1" FIBERGLASS PIPE INSULATION, 1" THCK	L.F.	180.0	$0.62	$112	Q-14	0.073	$242	$354
16	CNTV1.5	CONTROL VALVE 1-1/2"	EA.	1.0	$276.17	$276	1-PLUM	0.727	$16	$292
17	CNTV0.75	CONTROL VALVE 3/4"	EA.	3.0	$153.10	$459	1-PLUM	0.444	$29	$488
18	VSD5	VARIABLE SPEED DRIVE W/ CONTRLER,5HP	EA.	1.0	$2,444.79	$2,445	1-ELEC	10.5	$220	$2,665
19	REHEAT3	REHEAT COIL, 2ROW, 3'x1'	EA.	1.0	$154.07	$154	Q-5	1.32	$26	$180
20	REHEAT2	REHEAT COIL, 2ROW, 24"x12"	EA.	2.0	$138.57	$277	Q-5	1.32	$51	$328
21										
22										
23										
24										
25		*EXISTING SYSTEMS DEMOLITION*								
26		AHU DEMO	TON	2.8			Q-5	17.778	$948	$948
27		DUCT DEMO	L.F.	75.0			1-CLAB	0.119	$129	$129
28		ASBESTOS REMOVAL	GLV. BAG	8.0	$170.00	$1,360				$1,360
29										
30										
31		**SUBTOTAL**				$11,359			$4,629	$15,988
32	OH	OVERHEAD			17%	$1,908			$778	$2,686
33	PRO	PROFIT			10%	$1,327			$541	$1,867
34	CONT	CONTINGENCY			20%	$2,919			$1,189	$4,108
35	**TOTAL COST**		-	-	-	$17,513	-	-	$7,136	$24,649

ENGINEER'S OPINION OF PROBABLE COST

PROJECT	Fort Riley Feasibility Study for HVAC Upgrade	SHEET 1 OF 1	
ENGINEER	E M C Engineers, Inc.	DATE PREPARED	4-May-95
	Denver, CO	ESTIMATOR	C. Wohlert
		CHECKED BY	A. Niemeyer

Line No.	Item Refer Code	Item Description	Unit of Measure	MATERIAL COST Quantity	MATERIAL COST Unit Cost	MATERIAL COST Total	LABOR COST Crew/ Worker	LABOR COST Hours/ Unit	LABOR COST Total	TOTAL
1		**BUILDING 7739**								
2		**NON-RECURRING**								
3										
4		*EXISTING SYSTEM REPLACEMENT*								
5	AHUH8000	8,000 CFM AHU	EA.	1.0	$5,319.81	$5,320	Q-6	42	$844	$6,164
6	DUCT500	GAL. STEEL DUCTWORK, 200 TO 500 LB.	LB.	650.0	$0.47	$302	Q-10	0.098	$1,238	$1,540
7	E-TSTAT1	SINGLE SETPOINT ELEC. TSTAT, 3 WIRE	EA.	3.0	$24.23	$73	1-ELEC	0.8	$50	$123
8	WIRE#12	COPPER WIRING #12	C.L.F.	2.5	$7.41	$19	1-ELEC	0.727	$38	$57
9	STLPIP2	STEEL PIPE SCH. 40, 2" W/HANGERS	L.F.	30.0	$3.91	$117	Q-1	0.25	$145	$263
10		FITTINGS ADD 5%				$6			$7	$13
11	INSLPIP2	2" FIBERGLASS PIPE INSULATION, 1.5" THCK	L.F.	30.0	$1.46	$44	Q-14	0.084	$46	$90
12	CNTV1.5	CONTROL VALVE 1-1/2"	EA.	1.0	$276.17	$276	1-PLUM	0.727	$16	$292
13										
14										
15										
16										
17										
18										
19										
20										
21										
22										
23										
24										
25		*EXISTING SYSTEMS DEMOLITION*								
26		AHU DEMO	TON	2.8			Q-5	17.778	$948	$948
27		DUCT DEMO	L.F.	75.0			1-CLAB	0.119	$129	$129
28										
29										
30										
31		**SUBTOTAL**				$6,157			$3,462	$9,619
32	OH	OVERHEAD			17%	$1,034			$582	$1,616
33	PRO	PROFIT			10%	$719			$404	$1,123
34	CONT	CONTINGENCY			20%	$1,582			$890	$2,472
35	**TOTAL COST**		-	-	-	$9,492	-	-	$5,338	$14,830

ENGINEER'S OPINION OF PROBABLE COST

PROJECT	Fort Riley Feasibility Study for HVAC Upgrade	**SHEET** 1 **OF** 1	
ENGINEER	E M C Engineers, Inc.	**DATE PREPARED**	4-Mar-95
	Denver, CO	**ESTIMATOR**	C. Wohlert
		CHECKED BY	A. Niemeyer

Line No.	Item Refer Code	Item Description	Unit of Measure	MATERIAL COST Quantity	MATERIAL COST Unit Cost	MATERIAL COST Total	LABOR COST Crew/ Worker	LABOR COST Hours/ Unit	LABOR COST Total	TOTAL
1		**BUILDING 7739**								
2		***ANNUAL RECURRING***								
3		***ANNUAL MAINTENANCE COST - BASELINE***								
4										
5										
6										
7										
8										
9										
10										
11										
12										
13										
14										
15	**TOTAL ANNUAL MAINTENANCE COST - BASELINE**		-	-	-	$0	-	-	$0	$0
16										
17		***ANNUAL MAINTENANCE COST - NEW HVAC REPLACEMENT***								
18										
19										
20										
21										
22										
23										
24										
25										
26										
27										
28										
29	**TOTAL ANNUAL MAINTENANCE COST - BASELINE**		-	-	-	$0	-	-	$0	$0
30										
31										
32										
33										
34										
35	**TOTAL ANNUAL MAINTENANCE COST SAVINGS**		-	-	-	$0	-	-	$0	$0

DEMAND LIMITING ANALYSIS BUILDING 7739

	1993	1993	1993	1993	1993	1993	1993	1993	1993	1993	1993	1993
SUMMER PEAK (KW) =	JUL BILL	AUG BILL	SEP BILL	OCT BILL	NOV BILL	DEC BILL	JAN BILL	FEB BILL	MAR BILL	APR BILL	MAY BILL	JUN BILL
27812	7/1-8/2	8/2-9/1	9/3-10/1	10/1-11/1	11/1-12/1	12/1-1/3	1/4-2/1	2/1-3/1	3/3-4/1	4/1-5/3	5/3-6/1	6/1-7/1
	ACTUAL	ACTUAL	ACTUAL	ACTUAL	ACTUAL	ACTUAL	ACTUAL	ACTUAL	ACTUAL	ACTUAL	ACTUAL	ACTUAL
BASE CASE												
CAPACITY (KW)	32472	34452	26136	20754	26400	22752	27108	25812	23310	21834	21996	30096
POWER FACTOR (%)	99.20%	99.10%	99.10%	99.90%	99.80%	99.70%	99.50%	99.60%	99.60%	99.80%	99.60%	98.80%
CAPACITY (KVA)	32734	34765	26373	20775	26453	22820	27244	25916	23404	21878	22084	30462
80% SUMMER PEAK (KVA)	27812	27812	27812	27812	27812	27812	27812	27812	27812	27812	27812	27812
CONTRACT MINIMUM (KVA)	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643
BILLING CAPACITY (KVA)	32734	34765	27812	27812	27812	27812	27812	27812	27812	27812	27812	30462
ACTUAL OR 80% PEAK	ACTUAL	ACTUAL	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	ACTUAL
200 KVA @ $4.45	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00
NEXT 400 @ $4.25	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00
REMAINING @ $4.05	$130,142.18	$138,367.78	$110,208.22	$110,208.22	$110,208.22	$110,208.22	$110,208.22	$110,208.22	$110,208.22	$110,208.22	$110,208.22	$120,939.23
SUB DISCOUNT $.20	($6,546.77)	($6,952.98)	($5,562.38)	($5,562.38)	($5,562.38)	($5,562.38)	($5,562.38)	($5,562.38)	($5,562.38)	($5,562.38)	($5,562.38)	($6,092.31)
CAPACITY CHARGE	$126,185.40	$134,004.80	$107,235.84	$107,235.84	$107,235.84	$107,235.84	$107,235.84	$107,235.84	$107,235.84	$107,235.84	$107,235.84	$117,436.92
TOTAL ENERGY (KWH)	16,920,000	16,200,000	10,980,000	10,140,000	11,160,000	12,930,000	12,600,000	12,270,000	12,480,000	11,070,000	9,720,000	13,170,000
50*KVA @ $.03924	$64,223.85	$68,208.70	$54,566.96	$54,566.96	$54,566.96	$54,566.96	$54,566.96	$54,566.96	$54,566.96	$54,566.96	$54,566.96	$59,765.54
100*KVA @ $.03404	$111,426.10	$118,339.66	$94,671.73	$94,671.73	$94,671.73	$94,671.73	$94,671.73	$94,671.73	$94,671.73	$94,671.73	$94,671.73	$103,691.08
250*KVA @ $.03084	$252,378.15	$268,037.26	$209,965.32	$184,059.72	$214,429.80	$214,429.80	$214,429.80	$214,429.80	$214,429.80	$212,740.92	$171,106.92	$234,858.46
EXCESS @ $.02864	$109,589.57	$65,701.49	$0.00	$0.00	$1,009.19	$51,701.99	$42,250.79	$32,799.59	$38,813.99	$0.00	$0.00	$28,221.42
ENERGY CHARGE	$537,617.67	$520,287.11	$359,204.01	$333,298.41	$364,677.69	$415,370.49	$405,919.29	$396,468.09	$402,482.49	$361,979.61	$320,345.61	$426,536.49
TOTAL CHARGE LESS ECA	$663,803.07	$654,291.92	$466,439.85	$440,534.25	$471,913.53	$522,606.33	$513,155.13	$503,703.93	$509,718.33	$469,215.45	$427,581.45	$543,973.42
DEMAND REDUCTION (KW)	**5.18**	**5.31**	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**5.26**
CAPACITY (KW)	32467	34447	26136	20754	26400	22752	27108	25812	23310	21834	21996	30091
POWER FACTOR (%)	99.20%	99.10%	99.10%	99.90%	99.80%	99.70%	99.50%	99.60%	99.60%	99.80%	99.60%	98.80%
CAPACITY (KVA)	32729	34760	26373	20775	26453	22820	27244	25916	23404	21878	22084	30456
80% SUMMER PEAK (KVA)	27808	27808	27808	27808	27808	27808	27808	27808	27808	27808	27808	27808
CONTRACT MINIMUM (KVA)	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643
BILLING CAPACITY (KVA)	32729	34760	27808	27808	27808	27808	27808	27808	27808	27808	27808	30456
ACTUAL OR 80% PEAK	ACTUAL	ACTUAL	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	ACTUAL
200 KVA @ $4.45	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00
NEXT 400 @ $4.25	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00
REMAINING @ $4.05	$130,121.02	$138,346.06	$110,190.85	$110,190.85	$110,190.85	$110,190.85	$110,190.85	$110,190.85	$110,190.85	$110,190.85	$110,190.85	$120,917.65
SUB DISCOUNT $.20	($6,545.73)	($6,951.90)	($5,561.52)	($5,561.52)	($5,561.52)	($5,561.52)	($5,561.52)	($5,561.52)	($5,561.52)	($5,561.52)	($5,561.52)	($6,091.24)
CAPACITY CHARGE	$126,165.29	$133,984.16	$107,219.33	$107,219.33	$107,219.33	$107,219.33	$107,219.33	$107,219.33	$107,219.33	$107,219.33	$107,219.33	$117,416.41
TOTAL ENERGY (KWH)	16,920,000	16,200,000	10,980,000	10,140,000	11,160,000	12,930,000	12,600,000	12,270,000	12,480,000	11,070,000	9,720,000	13,170,000
50*KVA @ $.03924	$64,213.61	$68,198.18	$54,558.55	$54,558.55	$54,558.55	$54,558.55	$54,558.55	$54,558.55	$54,558.55	$54,558.55	$54,558.55	$59,755.09
100*KVA @ $.03404	$111,408.32	$118,321.41	$94,657.13	$94,657.13	$94,657.13	$94,657.13	$94,657.13	$94,657.13	$94,657.13	$94,657.13	$94,657.13	$103,672.94
250*KVA @ $.03084	$252,337.87	$267,995.91	$209,985.16	$184,079.56	$214,396.73	$214,396.73	$214,396.73	$214,396.73	$214,396.73	$212,760.76	$171,126.76	$234,817.39
EXCESS @ $.02864	$109,649.41	$65,762.92	$0.00	$0.00	$1,058.33	$51,751.13	$42,299.93	$32,848.73	$38,863.13	$0.00	$0.00	$28,282.45
ENERGY CHARGE	$537,609.21	$520,278.43	$359,200.84	$333,295.24	$364,670.74	$415,363.54	$405,912.34	$396,461.14	$402,475.54	$361,976.44	$320,342.44	$426,527.86
TOTAL CHARGE LESS ECA	$663,774.50	$654,262.59	$466,420.16	$440,514.56	$471,890.07	$522,582.87	$513,131.67	$503,680.47	$509,694.87	$469,195.76	$427,561.76	$543,944.27
SUMMARY												
MONTHLY DIFFERENCE	$28.57	$29.33	$19.69	$19.69	$23.46	$23.46	$23.46	$23.46	$23.46	$19.69	$19.69	$29.14
ANNUAL DIFFERENCE.............		**$283**										

BUILDING 6620A
ANNUAL ENERGY SAVINGS SUMMARY

Item	Baseline	ECO	Annual Energy Savings	Adj. Annual Energy Savings*
Annual Electric (MBTU)	581.63	386.30	195.33	175.94
Annual Natural Gas (MBTU)	573.02	582.46	-9.44	-8.50
Electric Demand June (KW)	53.52	53.90	-0.38	-0.35
Electric Demand July (KW)	55.05	56.92	-1.86	-1.68
Electric Demand August (KW)	56.69	59.58	-2.89	-2.60

*Energy savings prorated on a square foot basis:

Baseline Model Bldg 7108 (sq.ft.)	12179
ECO Model Bldg 6620A (sq.ft.)	10970
Square Footage Adjustment Factor	0.901

LIFE CYCLE COST ANALYSIS SUMMARY
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

LOCATION:	Fort Riley	REGION: 2 (Kansas)		PROJECT NO:	1406-005
PROJECT TITLE:	Feasibility Study for HVAC Upgrade			FISCAL YEAR:	1995
ANALYSIS DATE:	05/04/95	ECONOMIC LIFE:	20	PREPARED BY:	C. Wohlert

1. INVESTMENT: **BLDG 6620 - Convert MZ AHU to VAV AHU**

A.	CONSTRUCTION COST	=	$11,727	
B.	SIOH COST	(5.5% of 1A) =	$645	
C.	DESIGN COST	(6.0% of 1A) =	$704	
D.	TOTAL COST	(1A +1B +1C) =	$13,076	
E.	SALVAGE VALUE OF EXISTING EQUIPMENT =		$0	
F.	PUBLIC UTILITY COMPANY REBATE =		$0	
G.	TOTAL INVESTMENT	(1D -1E -1F) =	------->	$13,076

2. ENERGY SAVINGS (+) OR COST (-):

DATE OF NISTR 85-3273-9 USED FOR DISCOUNT FACTORS: JAN '95

	ENERGY SOURCE	FUEL COST $/MBTU (1)	SAVINGS MBTU/YR (2)	ANNUAL $ SAVINGS (3)	DISCOUNT FACTOR (4)	DISCOUNTED SAVINGS (5)	
A.	ELECT.	$12.10	176	$2,129	15.88	$33,807	
B.	DIST	$0.00	0	$0	19.16	$0	
C.	NAT GAS	$4.12	(9)	($35)	18.30	($641)	
D.	COAL	$0.00	0	$0	16.62	$0	
E.	ELEC. DEMAND			($122)	14.88	($1,808)	
F.	TOTAL		167	$1,972		-------->	$31,358

3. NON-ENERGY SAVINGS (+) OR COST (-)

A. ANNUAL RECURRING (+/-)

1 ANNUAL MAINTENANCE	$0	14.88	$0
2	$0	14.88	$0
3	$0	14.88	$0
4 TOTAL ANNUAL DISC. SAVINGS (+) / COST	$0		$0

B. NON-RECURRING (+/-)

ITEM	SAVINGS (+) COST(-) (1)	YEAR OF OCCURRENCE (2)	DISCOUNT FACTOR (3) (TABLE A-2)	DISCOUNTED SAVINGS/COST (4)
a. BASELINE EQUIP. REPLCMNT.	$0	5	0.863	$0
b.				$0
c.				$0
d.				$0
e.				$0
f. TOTAL	$0			$0

C. TOTAL NON-ENERGY DISCOUNTED SAVINGS (+) OR COST (-) (3A4 + 3Bf4) = $0

4.	FIRST YEAR DOLLAR SAVINGS (+) / COSTS (-)	(2F3+3A4+(3Bf1/Economic Life))	$1,972
5.	SIMPLE PAYBACK (SPB) IN YEARS (MUST BE < 10 YEARS TO QUALIFY)	(1G/4) =	6.63
6.	TOTAL NET DISCOUNTED SAVINGS	(2F5 + 3C) =	$31,358
7.	DISCOUNTED SAVINGS-TO-INVESTMENT RATIO (SIR) (MUST HAVE SIR > 1.25 TO QUALIFY)	(6/1G) =	2.40

ENGINEER'S OPINION OF PROBABLE COST

PROJECT	Fort Riley Feasibility Study for HVAC Upgrade	**SHEET** 1 **OF** 1	
		DATE PREPARED	4-May-95
ENGINEER	E M C Engineers, Inc.	**ESTIMATOR**	C. Wohlert
	Denver, CO	**CHECKED BY**	A. Niemeyer

Line No.	Item Refer Code	Item Description	Unit of Measure	MATERIAL COST Quantity	MATERIAL COST Unit Cost	MATERIAL COST Total	LABOR COST Crew/ Worker	LABOR COST Hours/ Unit	LABOR COST Total	TOTAL
1		**BUILDING 6620**								
2		**PROPOSED SYSTEM MODIFICATIONS**								
3										
4		*MZ AHU CONVERSION TO VAV*								
5	VAVBX5	VAV BOX, 500 CFM, ELEC	EA.	2.0	$266.48	$533	1-SHEE	0.98	$41	$574
6	VAVBX8	VAV BOX, 800 CFM, ELEC	EA.	1.0	$269.38	$269	1-SHEE	1.0	$21	$290
7	VAVBX20	VAV BOX, 2000 CFM, ELEC	EA.	2.0	$279.07	$558	1-SHEE	1.22	$51	$609
8	VAVBX35	VAV BOX, 3500 CFM, ELEC	EA.	2.0	$310.08	$620	1-SHEE	1.48	$62	$682
9	E-TSTAT1	SINGLE SETPOINT ELEC. TSTAT, 3 WIRE	EA.	7.0	$24.23	$170	1-ELEC	0.8	$117	$287
10	WIRE#12	COPPER WIRING #12	C.L.F.	3.5	$7.41	$26	1-ELEC	0.73	$53	$79
11	VSD7.5	VARIABLE SPEED DRIVE W/ CONTRLER,7.5HP	EA.	1.0	$2,728.70	$2,729	1-ELEC	12.5	$262	$2,990
12	ELE-SWIT	DDC SWITCH	EA.	1.0	$69.77	$70	1-STPI	0.5	$11	$81
13	DUCT1000	GAL. STEEL DUCTWORK, 500 TO 1000 LB.	LB.	300.0	$0.47	$140	Q-10	0.094	$548	$687
14	DTINSL2"	DUCT INSLULATION, 2" THICK	S.F.	250.0	$0.83	$208	Q-14	0.053	$244	$452
15	ACTUAT	SMALL ELECTIRIC ACTUATOR	EA.	7.0	$96.90	$678	1-ELEC	0.35	$51	$730
16										
17										
18										
19										
20										
21										
22										
23										
24										
25										
26										
27		*EXISTING SYSTEMS DEMOLITION*								
28		SELECTIVE DUCT DEMOLITION	LB	300.0			Q-5	0.025	$145	$145
29										
30										
31		**SUBTOTAL**				$6,001			$1,606	$7,606
32	OH	OVERHEAD			17%	$1,008			$270	$1,278
33	PRO	PROFIT			10%	$701			$188	$888
34	CONT	CONTINGENCY			20%	$1,542			$413	$1,955
35	**TOTAL COST**		-	-	-	$9,252	-	-	$2,475	$11,727

ENGINEER'S OPINION OF PROBABLE COST		SHEET 1	OF 1
PROJECT	Fort Riley Feasibility Study for HVAC Upgrade	DATE PREPARED	4-May-95
ENGINEER	E M C Engineers, Inc. Denver, CO	ESTIMATOR	C. Wohlert
		CHECKED BY	A. Niemeyer

Line No.	Item Refer Code	Item Description	Unit of Measure	MATERIAL COST Quantity	MATERIAL COST Unit Cost	MATERIAL COST Total	LABOR COST Crew/ Worker	LABOR COST Hours/ Unit	LABOR COST Total	TOTAL
1		**BUILDING 6620**								
2		**NON-RECURRING**								
3										
4		*EXISTING SYSTEM REPLACEMENT*								
5										
6										
7										
8										
9										
10										
11										
12										
13										
14										
15										
16										
17										
18										
19										
20										
21										
22										
23										
24										
25										
26										
27		*EXISTING SYSTEMS DEMOLITION*								
28										
29										
30										
31		**SUBTOTAL**				$0			$0	$0
32	OH	OVERHEAD			17%	$0			$0	$0
33	PRO	PROFIT			10%	$0			$0	$0
34	CONT	CONTINGENCY			20%	$0			$0	$0
35	**TOTAL COST**		-	-	-	$0	-	-	$0	$0

ENGINEER'S OPINION OF PROBABLE COST

PROJECT	Fort Riley Feasibility Study for HVAC Upgrade	SHEET 1	OF 1
ENGINEER	E M C Engineers, Inc.	DATE PREPARED	4-May-95
	Denver, CO	ESTIMATOR	C. Wohlert
		CHECKED BY	A. Niemeyer

Line No.	Item Refer Code	Item Description	Unit of Measure	MATERIAL COST Quantity	MATERIAL COST Unit Cost	MATERIAL COST Total	LABOR COST Crew/ Worker	LABOR COST Hours/ Unit	LABOR COST Total	TOTAL
1		**BUILDING 6620**								
2		***ANNUAL RECURRING***								
3		***ANNUAL MAINTENANCE COST - BASELINE***								
4										
5										
6										
7										
8										
9										
10										
11										
12										
13										
14										
15	**TOTAL ANNUAL MAINTENANCE COST - BASELINE**		-	-	-	$0	-	-	$0	$0
16										
17		***ANNUAL MAINTENANCE COST - NEW HVAC REPLACEMENT***								
18										
19										
20										
21										
22										
23										
24										
25										
26										
27										
28										
29	**TOTAL ANNUAL MAINTENANCE COST - BASELINE**		-	-	-	$0	-	-	$0	$0
30										
31										
32										
33										
34										
35	**TOTAL ANNUAL MAINTENANCE COST SAVINGS**		-	-	-	$0	-	-	$0	$0

DEMAND LIMITING ANALYSIS BUILDING 6620A

SUMMER PEAK (KW) = 27812	1993 JUL BILL 7/1-8/2 ACTUAL	1993 AUG BILL 8/2-9/1 ACTUAL	1993 SEP BILL 9/3-10/1 ACTUAL	1993 OCT BILL 10/1-11/1 ACTUAL	1993 NOV BILL 11/1-12/1 ACTUAL	1993 DEC BILL 12/1-1/3 ACTUAL	1993 JAN BILL 1/4-2/1 ACTUAL	1993 FEB BILL 2/1-3/1 ACTUAL	1993 MAR BILL 3/3-4/1 ACTUAL	1993 APR BILL 4/1-5/3 ACTUAL	1993 MAY BILL 5/3-6/1 ACTUAL	1993 JUN BILL 6/1-7/1 ACTUAL
BASE CASE												
CAPACITY (KW)	32472	34452	26136	20754	26400	22752	27108	25812	23310	21834	21996	30096
POWER FACTOR (%)	99.20%	99.10%	99.10%	99.90%	99.80%	99.70%	99.50%	99.60%	99.60%	99.80%	99.60%	98.80%
CAPACITY (KVA)	32734	34765	26373	20775	26453	22820	27244	25916	23404	21878	22084	30462
80% SUMMER PEAK (KVA)	27812	27812	27812	27812	27812	27812	27812	27812	27812	27812	27812	27812
CONTRACT MINIMUM (KVA)	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643
BILLING CAPACITY (KVA)	32734	34765	27812	27812	27812	27812	27812	27812	27812	27812	27812	30462
ACTUAL OR 80% PEAK	ACTUAL	ACTUAL	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	ACTUAL
200 KVA @ $4.45	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00
NEXT 400 @ $4.25	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00
REMAINING @ $4.05	$130,142.18	$138,367.78	$110,208.22	$110,208.22	$110,208.22	$110,208.22	$110,208.22	$110,208.22	$110,208.22	$110,208.22	$110,208.22	$120,939.23
SUB DISCOUNT $.20	($6,546.77)	($6,952.98)	($5,562.38)	($5,562.38)	($5,562.38)	($5,562.38)	($5,562.38)	($5,562.38)	($5,562.38)	($5,562.38)	($5,562.38)	($6,092.31)
CAPACITY CHARGE	$126,185.40	$134,004.80	$107,235.84	$107,235.84	$107,235.84	$107,235.84	$107,235.84	$107,235.84	$107,235.84	$107,235.84	$107,235.84	$117,436.92
TOTAL ENERGY (KWH)	16,920,000	16,200,000	10,980,000	10,140,000	11,160,000	12,930,000	12,600,000	12,270,000	12,480,000	11,070,000	9,720,000	13,170,000
50*KVA @ $.03924	$64,223.85	$68,208.70	$54,566.96	$54,566.96	$54,566.96	$54,566.96	$54,566.96	$54,566.96	$54,566.96	$54,566.96	$54,566.96	$59,765.54
100*KVA @ $.03404	$111,426.10	$118,339.66	$94,671.73	$94,671.73	$94,671.73	$94,671.73	$94,671.73	$94,671.73	$94,671.73	$94,671.73	$94,671.73	$103,691.08
250*KVA @ $.03084	$252,378.15	$268,037.26	$209,965.32	$184,059.72	$214,429.80	$214,429.80	$214,429.80	$214,429.80	$214,429.80	$212,740.92	$171,106.92	$234,858.46
EXCESS @ $.02864	$109,589.57	$65,701.49	$0.00	$0.00	$1,009.19	$51,701.99	$42,250.79	$32,799.59	$38,813.99	$0.00	$0.00	$28,221.42
ENERGY CHARGE	$537,617.67	$520,287.11	$359,204.01	$333,298.41	$364,677.69	$415,370.49	$405,919.29	$396,468.09	$402,482.49	$361,979.61	$320,345.61	$426,536.49
TOTAL CHARGE LESS ECA	$663,803.07	$654,291.92	$466,439.85	$440,534.25	$471,913.53	$522,606.33	$513,155.13	$503,703.93	$509,718.33	$469,215.45	$427,581.45	$543,973.42
DEMAND REDUCTION (KW)	**(1.68)**	**(2.60)**	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**(0.35)**
CAPACITY (KW)	32474	34455	26136	20754	26400	22752	27108	25812	23310	21834	21996	30096
POWER FACTOR (%)	99.20%	99.10%	99.10%	99.90%	99.80%	99.70%	99.50%	99.60%	99.60%	99.80%	99.60%	98.80%
CAPACITY (KVA)	32736	34768	26373	20775	26453	22820	27244	25916	23404	21878	22084	30462
80% SUMMER PEAK (KVA)	27814	27814	27814	27814	27814	27814	27814	27814	27814	27814	27814	27814
CONTRACT MINIMUM (KVA)	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643
BILLING CAPACITY (KVA)	32736	34768	27814	27814	27814	27814	27814	27814	27814	27814	27814	30462
ACTUAL OR 80% PEAK	ACTUAL	ACTUAL	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	ACTUAL
200 KVA @ $4.45	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00
NEXT 400 @ $4.25	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00
REMAINING @ $4.05	$130,149.03	$138,378.41	$110,216.73	$110,216.73	$110,216.73	$110,216.73	$110,216.73	$110,216.73	$110,216.73	$110,216.73	$110,216.73	$120,940.65
SUB DISCOUNT $.20	($6,547.11)	($6,953.50)	($5,562.80)	($5,562.80)	($5,562.80)	($5,562.80)	($5,562.80)	($5,562.80)	($5,562.80)	($5,562.80)	($5,562.80)	($6,092.38)
CAPACITY CHARGE	$126,191.91	$134,014.91	$107,243.93	$107,243.93	$107,243.93	$107,243.93	$107,243.93	$107,243.93	$107,243.93	$107,243.93	$107,243.93	$117,438.27
TOTAL ENERGY (KWH)	16,920,000	16,200,000	10,980,000	10,140,000	11,160,000	12,930,000	12,600,000	12,270,000	12,480,000	11,070,000	9,720,000	13,170,000
50*KVA @ $.03924	$64,227.17	$68,213.85	$54,571.08	$54,571.08	$54,571.08	$54,571.08	$54,571.08	$54,571.08	$54,571.08	$54,571.08	$54,571.08	$59,766.23
100*KVA @ $.03404	$111,431.85	$118,348.60	$94,678.88	$94,678.88	$94,678.88	$94,678.88	$94,678.88	$94,678.88	$94,678.88	$94,678.88	$94,678.88	$103,692.27
250*KVA @ $.03084	$252,391.18	$268,057.49	$209,955.60	$184,050.00	$214,445.99	$214,445.99	$214,445.99	$214,445.99	$214,445.99	$212,731.20	$171,097.20	$234,861.17
EXCESS @ $.02864	$109,570.20	$65,671.42	$0.00	$0.00	$985.14	$51,677.94	$42,226.74	$32,775.54	$38,789.94	$0.00	$0.00	$28,217.39
ENERGY CHARGE	$537,620.41	$520,291.36	$359,205.56	$333,299.96	$364,681.09	$415,373.89	$405,922.69	$396,471.49	$402,485.89	$361,981.16	$320,347.16	$426,537.06
TOTAL CHARGE LESS ECA	$663,812.33	$654,306.27	$466,449.49	$440,543.89	$471,925.02	$522,617.82	$513,166.62	$503,715.42	$509,729.82	$469,225.09	$427,591.09	$543,975.34
SUMMARY												
MONTHLY DIFFERENCE	($9.25)	($14.36)	($9.64)	($9.64)	($11.48)	($11.48)	($11.48)	($11.48)	($11.48)	($9.64)	($9.64)	($1.92)
ANNUAL DIFFERENCE.............		**($121.50)**										

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EMC        ENGINEERS      INC.      EZDOE - ELITE SOFTWARE DEVELOPMENT INC      DOE-2.1D   2/17/1995     16:58: 9  LDL RUN 1
  DENVER,       CO        80227     EXISTING CONDITION OF BLDG. 6914 6620      EXCHANGE MAIN RETAIL
REPORT- LV-D  DETAILS OF EXTERIOR SURFACES IN THE PROJECT                              TOPEKA, KS
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NUMBER OF EXTERIOR SURFACES 14 RECTANGULAR 14 OTHER 0
(U-VALUE INCLUDES INSIDE AIR FILM PLUS OUTSIDE AIR FILM AT 7.5 MPH WINDSPEED)

SURFACE	SPACE	GLASS U-VALUE (BTU/HR-SQFT-F)	GLASS AREA (SQFT)	WALL U-VALUE (BTU/HR-SQFT-F)	WALL AREA (SQFT)	WALL+GLASS U-VALUE (BTU/HR-SQFT-F)	WALL+GLASS AREA (SQFT)	AZIMUTH
	SPACE_1	0.000	0.00	0.065	190.00	0.065	190.00	NORTH
	SPACE_3	0.000	0.00	0.065	360.00	0.065	360.00	NORTH
	SPACE_4	0.000	0.00	0.065	220.00	0.065	220.00	NORTH
	PLENUM_1	0.000	0.00	0.094	429.00	0.094	429.00	NORTH
	SPACE_4	0.000	0.00	0.103	420.00	0.103	420.00	EAST
	PLENUM_1	0.000	0.00	0.094	924.00	0.094	924.00	EAST
	SPACE_1	0.490	133.65	0.103	1136.35	0.144	1270.00	EAST
	SPACE_2	0.000	0.00	0.065	420.00	0.065	420.00	SOUTH
	PLENUM_1	0.000	0.00	0.094	429.00	0.094	429.00	SOUTH
	SPACE_1	0.000	0.00	0.065	360.00	0.065	360.00	SOUTH
	PLENUM_1	0.000	0.00	0.094	924.00	0.094	924.00	WEST
	SPACE_2	0.490	74.25	0.103	695.75	0.141	770.00	WEST
	SPACE_3	0.490	29.70	0.103	880.30	0.116	910.00	WEST
	PLENUM_1	0.000	0.00	0.128	17160.00	0.128	17160.00	ROOF
	SPACE_1	0.000	0.00	0.020	4445.00	0.020	4445.00	UNDERGRND
	SPACE_2	0.000	0.00	0.020	3234.00	0.020	3234.00	UNDERGRND
	SPACE_3	0.000	0.00	0.020	3570.00	0.020	3570.00	UNDERGRND
	SPACE_4	0.000	0.00	0.020	924.00	0.020	924.00	UNDERGRND


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EMC        ENGINEERS      INC.      EZDOE - ELITE SOFTWARE DEVELOPMENT INC      DOE-2.1D   2/17/1995     16:58: 9  LDL RUN 1
  DENVER,       CO        80227     EXISTING CONDITION OF BLDG. 6914           EXCHANGE MAIN RETAIL
REPORT- LV-D  DETAILS OF EXTERIOR SURFACES IN THE PROJECT                              TOPEKA, KS
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	AVERAGE U-VALUE/GLASS (BTU/HR-SQFT-F)	AVERAGE U-VALUE/WALLS (BTU/HR-SQFT-F)	AVERAGE U-VALUE WALLS+GLASS (BTU/HR-SQFT-F)	GLASS AREA (SQFT)	OPAQUE AREA (SQFT)	GLASS+OPAQUE AREA (SQFT)
NORTH	0.000	0.076	0.076	0.00	1199.00	1199.00
EAST	0.490	0.100	0.120	133.65	2480.35	2614.00
SOUTH	0.000	0.076	0.076	0.00	1209.00	1209.00
WEST	0.490	0.100	0.115	103.95	2500.05	2604.00
ROOF	0.000	0.128	0.128	0.00	17160.00	17160.00
ALL WALLS	0.490	0.092	0.104	237.60	7388.40	7626.00
WALLS+ROOFS	0.490	0.117	0.120	237.60	24548.40	24786.00
UNDERGRND	0.000	0.020	0.020	0.00	12173.00	12173.00
BUILDING	0.490	0.085	0.087	237.60	36721.40	36959.00

*** BUILDING ***

FLOOR AREA	12179	SQFT	1131	SQMT
VOLUME	188775	CUFT	5346	CUMT

	COOLING LOAD				HEATING LOAD	
TIME	AUG 24	6PM			JAN 16	6AM
DRY-BULB TEMP	93F	34C			10F	-12C
WET-BULB TEMP	76F	24C			8F	-13C
	SENSIBLE		LATENT		SENSIBLE	
	(KBTU/H)	(KW)	(KBTU/H)	(KW)	(KBTU/H)	(KW)
WALLS	5.905	1.729	0.000	0.000	-28.955	-8.480
ROOFS	0.000	0.000	0.000	0.000	0.000	0.000
GLASS CONDUCTION	2.382	0.698	0.000	0.000	-8.267	-2.421
GLASS SOLAR	6.870	2.012	0.000	0.000	0.609	0.178
DOOR	2.310	0.677	0.000	0.000	-6.229	-1.824
INTERNAL SURFACES	0.000	0.000	0.000	0.000	0.000	0.000
UNDERGROUND SURFACES	-1.152	-0.337	0.000	0.000	-6.990	-2.047
OCCUPANTS TO SPACE	14.248	4.173	25.373	7.431	0.031	0.009
LIGHT TO SPACE	53.232	15.590	0.000	0.000	0.177	0.052
EQUIPMENT TO SPACE	9.050	2.650	0.000	0.000	0.020	0.006
PROCESS TO SPACE	0.000	0.000	0.000	0.000	0.000	0.000
INFILTRATION	7.706	2.257	11.955	3.501	-19.339	-5.664
TOTAL	100.551	29.449	37.328	10.933	-68.942	-20.191
TOTAL LOAD	137.880 KBTU/H		40.382	KW	-68.942 KBTU/H	-20.191 KW
TOTAL LOAD / AREA	11.32BTU/H.SQFT		35.690	W /SQMT	5.661BTU/H.SQFT	17.845 W /SQMT

NOTE
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1) THE ABOVE LOADS EXCLUDE OUTSIDE VENTILATION AIR LOADS
2) TIMES GIVEN IN STANDARD TIME FOR THE LOCATION IN CONSIDERATION

EMC ENGINEERS INC. EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/17/1995 16:58: 9 SDL RUN 1
DENVER, CO 80227 EXISTING CONDITION OF BLDG. ~~6914~~ 6620 EXCHANGE MAIN RETAIL
REPORT- SS-A SYSTEM MONTHLY LOADS SUMMARY FOR MZ-FAN-SYS TOPEKA, KS

	COOLING						HEATING						ELEC	
MONTH	COOLING ENERGY (MBTU)	TIME OF MAX DY	TIME OF MAX HR	DRY-BULB TEMP	WET-BULB TEMP	MAXIMUM COOLING LOAD (KBTU/HR)	HEATING ENERGY (MBTU)	TIME OF MAX DY	TIME OF MAX HR	DRY-BULB TEMP	WET-BULB TEMP	MAXIMUM HEATING LOAD (KBTU/HR)	ELEC-TRICAL ENERGY (KWH)	MAXIMUM ELEC LOAD (KW)
JAN	0.00000					0.000	-97.658	15	8	-6.F	-7.F	-269.834	10297.	26.603
FEB	0.00000					0.000	-72.351	3	5	-1.F	-2.F	-234.104	9308.	26.603
MAR	0.00000					0.000	-53.819	14	4	16.F	15.F	-190.372	10790.	26.603
APR	0.00000					0.000	-15.907	5	5	31.F	29.F	-128.261	10132.	26.603
MAY	32.54854	31	18	90.F	76.F	270.086	-2.893	9	5	45.F	44.F	-81.411	10297.	26.603
JUN	79.81097	29	15	88.F	75.F	266.428	0.000					0.000	10378.	26.603
JUL	98.05341	7	18	83.F	74.F	291.979	0.000					0.000	10050.	26.603
AUG	99.07893	4	17	92.F	70.F	281.196	0.000					0.000	10790.	26.603
SEP	51.91270	7	15	92.F	76.F	256.304	0.000					0.000	10132.	26.603
OCT	0.32368	1	18	83.F	68.F	58.001	-13.963	2	2	64.F	59.F	-176.391	10050.	26.603
NOV	0.00000					0.000	-45.483	3	5	13.F	12.F	-183.070	9885.	26.603
DEC	0.00000					0.000	-86.754	15	5	8.F	7.F	-229.569	10297.	26.603
TOTAL	361.729						-388.826						122407.	
MAX						291.979						-269.834		26.603

EMC ENGINEERS INC. EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/17/1995 16:58: 9 SDL RUN 1
DENVER, CO 80227 EXISTING CONDITION OF BLDG. 6914 EXCHANGE MAIN RETAIL
REPORT- SS-C SYSTEM MONTHLY LOAD HOURS FOR MZ-FAN-SYS TOPEKA, KS

	NUMBER OF HOURS										COINCIDENT LOADS	
MONTH	HOURS COOLING LOAD	HOURS HEATING LOAD	HOURS COINCIDENT COOL-HEAT LOAD	HOURS FLOATING	HOURS HEATING AVAIL.	HOURS COOLING AVAIL.	HOURS FANS ON	HOURS FANS CYCLE ON	HOURS NIGHT VENTING	HOURS FLOATING WHEN FANS ON	HEATING LOAD AT COOLING PEAK (KBTU/HR)	ELECTRIC LOAD AT COOLING PEAK (KW)
JAN	0	744	0	0	744	0	744	0	0	0	-118.080	6.882
FEB	0	672	0	0	672	0	672	0	0	0	-121.898	6.882
MAR	0	744	0	0	744	0	744	0	0	0	-117.566	6.882
APR	0	720	0	0	720	0	720	0	0	0	-0.036	6.882
MAY	338	360	0	46	360	384	744	0	0	46	0.000	26.603
JUN	688	0	0	32	0	720	720	0	0	32	0.000	26.603
JUL	740	0	0	4	0	744	744	0	0	4	0.000	26.603
AUG	727	0	0	17	0	744	744	0	0	17	0.000	26.603
SEP	513	0	0	207	0	720	720	0	0	207	0.000	26.603
OCT	10	720	0	14	720	24	744	0	0	14	0.000	6.882
NOV	0	720	0	0	720	0	720	0	0	0	-138.580	6.882
DEC	0	744	0	0	744	0	744	0	0	0	-158.907	6.882
ANNUAL	3016	5424	0	320	5424	3336	8760	0	0	320		

EMC ENGINEERS INC. EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/17/1995 16:58: 9 PDL RUN 1
DENVER, CO 80227 EXISTING CONDITION OF BLDG. ~~6914~~ 6620 EXCHANGE MAIN RETAIL
REPORT- PS-B MONTHLY PEAK AND TOTAL ENERGY USE TOPEKA, KS

MO	UTILITY-	ELECTRICITY	NATURAL-GAS
	TOTAL(MBTU)	40.189	136.994
JAN	PEAK(KBTU)	97.975	339.352
	DY/HR	31/11	15/ 8
	TOTAL(MBTU)	36.203	105.060
FEB	PEAK(KBTU)	97.975	301.456
	DY/HR	28/11	3/ 5
	TOTAL(MBTU)	40.856	81.006
MAR	PEAK(KBTU)	97.975	253.804
	DY/HR	31/10	14/ 4
	TOTAL(MBTU)	36.709	26.754
APR	PEAK(KBTU)	97.975	183.724
	DY/HR	15/ 8	5/ 5
	TOTAL(MBTU)	48.449	5.682
MAY	PEAK(KBTU)	183.475	128.996
	DY/HR	31/18	9/ 5
	TOTAL(MBTU)	65.374	0.000
JUN	PEAK(KBTU)	182.657	0.000
	DY/HR	28/16	30/ 1
	TOTAL(MBTU)	70.682	0.000
JUL	PEAK(KBTU)	187.901	0.000
	DY/HR	22/16	31/ 1
	TOTAL(MBTU)	74.395	0.000
AUG	PEAK(KBTU)	193.495	0.000
	DY/HR	11/16	31/ 1
	TOTAL(MBTU)	54.750	0.000
SEP	PEAK(KBTU)	183.507	0.000
	DY/HR	7/16	30/ 1
	TOTAL(MBTU)	36.540	23.955
OCT	PEAK(KBTU)	97.975	238.275
	DY/HR	20/10	2/ 2
	TOTAL(MBTU)	37.350	69.199
NOV	PEAK(KBTU)	97.975	245.711
	DY/HR	30/12	3/ 5
	TOTAL(MBTU)	40.128	124.365
DEC	PEAK(KBTU)	97.975	296.580
	DY/HR	30/18	15/ 5
	ONE YEAR	581.624	573.016
	USE/PEAK	193.495	339.352

ENERGY TYPE IN SITE MBTU - CATEGORY OF USE	ELECTRICITY	NATURAL-GAS
SPACE HEAT	20.56	573.02
SPACE COOL	125.35	0.00
HVAC AUX	223.60	0.00
DOM HOT WTR	0.00	0.00
AUX SOLAR	0.00	0.00
LIGHTS	182.00	0.00
VERT TRANS	0.00	0.00
MISC EQUIP	30.11	0.00
TOTAL	581.63	573.02

TOTAL SITE ENERGY 1154.64 MBTU 94.1 KBTU/SQFT-YR GROSS-AREA 94.8 KBTU/SQFT-YR NET-AREA
TOTAL SOURCE ENERGY 2319.63 MBTU 189.0 KBTU/SQFT-YR GROSS-AREA 190.5 KBTU/SQFT-YR NET-AREA
PERCENT OF HOURS ANY SYSTEM ZONE OUTSIDE OF THROTTLING RANGE = 1.4
PERCENT OF HOURS ANY PLANT LOAD NOT SATISFIED = 0.0
NOTE ELECTRICITY AND/OR FUEL USED TO GENERATE ELECTRICITY IS APPORTIONED BASED ON THE YEARLY DEMAND. ALL OTHER ENERGY TYPES ARE APPORTIONED HOURLY.

EMC ENGINEERS INC. EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/23/1995 8:11: 2 SDL RUN 1
DENVER, CO 80227 PROPOSED MODIFICATION OF BLDG. ~~6914~~ 6620 EXCHANGE MAIN RETAIL
REPORT- SS-A SYSTEM MONTHLY LOADS SUMMARY FOR VAV-FN-SYS TOPEKA, KS

	COOLING						HEATING						ELEC	
MONTH	COOLING ENERGY (MBTU)	TIME OF MAX DY	HR	DRY-BULB TEMP	WET-BULB TEMP	MAXIMUM COOLING LOAD (KBTU/HR)	HEATING ENERGY (MBTU)	TIME OF MAX DY	HR	DRY-BULB TEMP	WET-BULB TEMP	MAXIMUM HEATING LOAD (KBTU/HR)	ELEC-TRICAL ENERGY (KWH)	MAXIMUM ELEC LOAD (KW)
JAN	0.00000					0.000	-94.394	15	6	-8.F	-9.F	-187.946	5469.	20.114
FEB	0.00000					0.000	-74.759	3	7	-5.F	-6.F	-177.294	4947.	20.114
MAR	0.00000					0.000	-59.635	4	7	14.F	12.F	-151.866	6059.	28.126
APR	0.00000					0.000	-23.133	5	5	31.F	29.F	-125.676	6392.	28.237
MAY	21.86016	31	18	90.F	76.F	237.048	-5.864	1	7	38.F	36.F	-96.923	6516.	28.237
JUN	58.67118	29	15	88.F	75.F	262.952	0.000					0.000	6536.	27.031
JUL	75.76686	7	18	83.F	74.F	302.770	0.000					0.000	6338.	28.237
AUG	78.28471	4	17	92.F	70.F	296.756	0.000					0.000	7269.	28.237
SEP	36.34599	7	16	93.F	76.F	247.936	0.000					0.000	5879.	26.872
OCT	0.50520	1	17	85.F	68.F	44.762	-21.400	20	5	25.F	25.F	-133.168	6117.	28.237
NOV	0.00000					0.000	-51.569	3	6	13.F	12.F	-150.979	5428.	28.237
DEC	0.00000					0.000	-86.561	13	8	0.F	-1.F	-174.066	5469.	20.114
TOTAL	271.434						-417.315						72417.	
MAX						302.770						-187.946		28.237

EMC ENGINEERS INC. EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/23/1995 8:11: 2 SDL RUN 1
DENVER, CO 80227 PROPOSED MODIFICATION OF BLDG. 6914 EXCHANGE MAIN RETAIL
REPORT- SS-C SYSTEM MONTHLY LOAD HOURS FOR VAV-FN-SYS TOPEKA, KS

	NUMBER OF HOURS										COINCIDENT LOADS	
MONTH	HOURS COOLING LOAD	HOURS HEATING LOAD	HOURS COINCIDENT COOL-HEAT LOAD	HOURS FLOATING	HOURS HEATING AVAIL.	HOURS COOLING AVAIL.	HOURS FANS ON	HOURS FANS CYCLE ON	HOURS NIGHT VENTING	HOURS FLOATING WHEN FANS ON	HEATING LOAD AT COOLING PEAK (KBTU/HR)	ELECTRIC LOAD AT COOLING PEAK (KW)
JAN	0	744	0	0	744	0	744	0	0	0	-124.823	0.392
FEB	0	672	0	0	672	0	672	0	0	0	-125.219	0.392
MAR	0	715	0	29	744	0	744	0	0	29	-118.789	0.392
APR	0	571	0	149	720	0	720	0	0	149	-50.695	0.392
MAY	384	246	0	114	360	384	744	0	0	114	0.000	24.952
JUN	720	0	0	0	0	720	720	0	0	0	0.000	26.845
JUL	744	0	0	0	0	744	744	0	0	0	0.000	28.237
AUG	744	0	0	0	0	744	744	0	0	0	0.000	28.216
SEP	720	0	0	0	0	720	720	0	0	0	0.000	26.458
OCT	24	563	0	157	720	24	744	0	0	157	0.000	0.392
NOV	0	671	0	49	720	0	720	0	0	49	-133.130	0.392
DEC	0	744	0	0	744	0	744	0	0	0	-132.636	0.392
ANNUAL	3336	4926	0	498	5424	3336	8760	0	0	498		

MO	UTILITY-	ELECTRICITY	NATURAL-GAS
	TOTAL(MBTU)	22.345	126.270
JAN	PEAK(KBTU)	73.650	236.367
	DY/HR	31/18	15/ 6
	TOTAL(MBTU)	20.194	102.243
FEB	PEAK(KBTU)	73.650	225.149
	DY/HR	28/14	3/ 7
	TOTAL(MBTU)	23.904	84.302
MAR	PEAK(KBTU)	96.036	197.889
	DY/HR	9/18	4/ 7
	TOTAL(MBTU)	23.782	35.717
APR	PEAK(KBTU)	97.635	169.101
	DY/HR	20/ 8	5/ 5
	TOTAL(MBTU)	33.342	9.664
MAY	PEAK(KBTU)	172.566	136.669
	DY/HR	31/18	1/ 7
	TOTAL(MBTU)	47.535	0.000
JUN	PEAK(KBTU)	183.971	0.000
	DY/HR	29/16	30/ 1
	TOTAL(MBTU)	52.552	0.000
JUL	PEAK(KBTU)	194.258	0.000
	DY/HR	22/18	31/ 1
	TOTAL(MBTU)	57.407	0.000
AUG	PEAK(KBTU)	203.350	0.000
	DY/HR	11/16	31/ 1
	TOTAL(MBTU)	38.304	0.000
SEP	PEAK(KBTU)	182.804	0.000
	DY/HR	7/16	30/ 1
	TOTAL(MBTU)	23.179	33.435
OCT	PEAK(KBTU)	97.391	177.410
	DY/HR	6/ 8	20/ 5
	TOTAL(MBTU)	21.455	73.548
NOV	PEAK(KBTU)	96.413	196.926
	DY/HR	23/18	3/ 6
	TOTAL(MBTU)	22.303	117.279
DEC	PEAK(KBTU)	73.650	221.726
	DY/HR	30/18	13/ 8
	ONE YEAR	386.301	582.457
	USE/PEAK	203.350	236.367

ENERGY TYPE IN SITE MBTU - CATEGORY OF USE	ELECTRICITY	NATURAL-GAS
SPACE HEAT	17.26	582.46
SPACE COOL	104.66	0.00
HVAC AUX	52.27	0.00
DOM HOT WTR	0.00	0.00
AUX SOLAR	0.00	0.00
LIGHTS	182.00	0.00
VERT TRANS	0.00	0.00
MISC EQUIP	30.11	0.00
TOTAL	386.30	582.46

TOTAL SITE ENERGY 968.76 MBTU 78.9 KBTU/SQFT-YR GROSS-AREA 79.5 KBTU/SQFT-YR NET-AREA
TOTAL SOURCE ENERGY 1742.52 MBTU 142.0 KBTU/SQFT-YR GROSS-AREA 143.1 KBTU/SQFT-YR NET-AREA
PERCENT OF HOURS ANY SYSTEM ZONE OUTSIDE OF THROTTLING RANGE = 23.9
PERCENT OF HOURS ANY PLANT LOAD NOT SATISFIED = 0.0
NOTE ELECTRICITY AND/OR FUEL USED TO GENERATE ELECTRICITY IS APPORTIONED BASED ON THE YEARLY DEMAND. ALL OTHER ENERGY TYPES ARE APPORTIONED HOURLY.

BUILDING 6620B
ANNUAL ENERGY SAVINGS SUMMARY

Item	Baseline	ECO	Annual Energy Savings	Adj. Annual Energy Savings*
Annual Electric (MBTU)	488.48	297.61	190.87	477.55
Annual Natural Gas (MBTU)	797.55	717.95	79.60	199.16
Electric Demand June (KW)	40.39	35.06	5.32	13.32
Electric Demand July (KW)	44.28	39.98	4.30	10.75
Electric Demand August (KW)	42.76	38.94	3.82	9.56

*Energy savings prorated on a square foot basis:

Baseline Model Bldg 7086 (sq.ft.)	4590
ECO Model Bldg 6620B (sq.ft.)	11484
Square Footage Adjustment Factor	2.502

LIFE CYCLE COST ANALYSIS SUMMARY
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

LOCATION:	Fort Riley	REGION: 2 (Kansas)		PROJECT NO:	1406-005
PROJECT TITLE:	Feasibility Study for HVAC Upgrade			FISCAL YEAR:	1995
ANALYSIS DATE:	05/04/95	ECONOMIC LIFE:	20	PREPARED BY:	C. Wohlert

1. INVESTMENT: **BLDG 6620 - Replace SZs AHUs w/ VAV AHUs**

A.	CONSTRUCTION COST	=	$42,220	
B.	SIOH COST	(5.5% of 1A) =	$2,322	
C.	DESIGN COST	(6.0% of 1A) =	$2,533	
D.	TOTAL COST	(1A +1B +1C) =	$47,075	
E.	SALVAGE VALUE OF EXISTING EQUIPMENT =		$0	
F.	PUBLIC UTILITY COMPANY REBATE =		$0	
G.	TOTAL INVESTMENT	(1D -1E -1F) =	------->	$47,075

2. ENERGY SAVINGS (+) OR COST (-):

DATE OF NISTR 85-3273-9 USED FOR DISCOUNT FACTORS: JAN '95

	ENERGY SOURCE	FUEL COST $/MBTU (1)	SAVINGS MBTU/YR (2)	ANNUAL $ SAVINGS (3)	DISCOUNT FACTOR (4)	DISCOUNTED SAVINGS (5)	
A.	ELECT.	$12.10	478	$5,778	15.88	$91,760	
B.	DIST	$0.00	0	$0	19.16	$0	
C.	NAT GAS	$4.12	199	$821	18.30	$15,016	
D.	COAL	$0.00	0	$0	16.62	$0	
E.	ELEC. DEMAND			$539	14.88	$8,016	
F.	TOTAL		677	$7,138		-------->	$114,793

3. NON-ENERGY SAVINGS (+) OR COST (-)

A. ANNUAL RECURRING (+/-)

1 ANNUAL MAINTENANCE	$0	14.88	$0
2	$0	14.88	$0
3	$0	14.88	$0
4 TOTAL ANNUAL DISC. SAVINGS (+) / COST	$0		$0

B. NON-RECURRING (+/-)

ITEM	SAVINGS (+) COST(-) (1)	YEAR OF OCCURRENCE (2)	DISCOUNT FACTOR (3) (TABLE A-2)	DISCOUNTED SAVINGS/COST (4)
a. BASELINE EQUIP. REPLCMNT.	$30,326	5	0.863	$26,171
b.				$0
c.				$0
d.				$0
e.				$0
f. TOTAL	$30,326			$26,171

C. TOTAL NON-ENERGY DISCOUNTED SAVINGS (+) OR COST (-) (3A4 + 3Bf4) = $26,171

4.	FIRST YEAR DOLLAR SAVINGS (+) / COSTS (-)	(2F3+3A4+(3Bf1/Economic Life))	$8,654
5.	SIMPLE PAYBACK (SPB) IN YEARS (MUST BE < 10 YEARS TO QUALIFY)	(1G/4) =	5.44
6.	TOTAL NET DISCOUNTED SAVINGS	(2F5 + 3C) =	$140,964
7.	DISCOUNTED SAVINGS-TO-INVESTMENT RATIO (SIR) (MUST HAVE SIR > 1.25 TO QUALIFY)	(6/1G) =	2.99

ENGINEER'S OPINION OF PROBABLE COST

PROJECT	Fort Riley Feasibility Study for HVAC Upgrade	**SHEET** 1 **OF** 1	
		DATE PREPARED	4-May-95
ENGINEER	E M C Engineers, Inc.	**ESTIMATOR**	C. Wohlert
	Denver, CO	**CHECKED BY**	A. Niemeyer

Line No.	Item Refer Code	Item Description	Unit of Measure	MATERIAL COST Quantity	Unit Cost	Total	LABOR COST Crew/ Worker	Hours/ Unit	Total	TOTAL
1		**BUILDING 6620**								
2		**PROPOSED SYSTEM MODIFICATIONS**								
3										
4		*NEW SYSTEMS INSTALLATION*								
5	AHU10000	10,000 CFM AHU, COOLING ONLY	EA.	2.0	$4,820.78	$9,642	Q-6	44.44	$1,787	$11,429
6	REHEAT4	REHEAT COIL, 2ROW, 3' x 2'	EA.	2.0	$193.80	$388	Q-5	3.96	$154	$541
7	REHEAT3	REHEAT COIL, 2ROW, 3'x1'	EA.	2.0	$154.07	$308	Q-5	1.3	$51	$359
8	VAVBX35	VAV BOX, 3500 CFM, ELEC	EA.	2.0	$310.08	$620	1-SHEE	1.48	$62	$682
9	VAVBX70	VAV BOX, 7000 CFM, ELEC	EA.	2.0	$353.69	$707	1-SHEE	2.6	$108	$816
10	STLPIP1	STEEL PIPE SCH. 40, 1" W/HANGERS	L.F.	145.0	$2.10	$305	Q-1	0.151	$425	$729
11	STLPIP2.5	STEEL PIPE SCH. 40, 2.5" W/HANGERS	L.F.	120.0	$5.28	$634	Q-15	0.34	$791	$1,425
12		FITTINGS, 5%				$47			$61	$108
13	E-TSTAT1	SINGLE SETPOINT ELEC. TSTAT, 3 WIRE	EA.	4.0	$24.23	$97	1-ELEC	0.8	$67	$164
14	WIRE#12	COPPER WIRING #12	C.L.F.	3.0	$7.41	$22	1-ELEC	0.73	$46	$68
15	VSD7.5	VARIABLE SPEED DRIVE W/ CONTRLER,7.5HP	EA.	2.0	$2,728.70	$5,457	1-ELEC	12.5	$523	$5,981
16	CNTV0.75	CONTROL VALVE 3/4"	EA.	4.0	$153.10	$612	1-PLUM	0.44	$38	$651
17	CNTV2	CONTROL VALVE 2"	EA.	2.0	$397.29	$795	1-PLUM	0.889	$38	$833
18	INSLPIP1	1" FIBERGLASS PIPE INSULATION, 1" THCK	L.F.	145.0	$0.62	$90	Q-14	0.073	$195	$285
19	INSLPIP2.5	2.5" FIBERGLASS PIPE INSULATION, 1.5" THCK	L.F.	120.0	$1.60	$192	Q-14	0.089	$197	$389
20	DUCT500	GAL. STEEL DUCTWORK, 200 TO 500 LB.	LB.	425.0	$0.47	$198	Q-10	0.098	$809	$1,007
21	DTINSL2"	DUCT INSLULATION, 2" THICK	S.F.	356.0	$0.83	$297	Q-14	0.053	$347	$644
22										
23										
24										
25										
26										
27		*EXISTING SYSTEMS DEMOLITION*								
28		AHU DEMO	TON	3.7			Q-5	17.778	$1,275	$1,275
29										
30										
31		**SUBTOTAL**				$20,410			$6,974	$27,384
32	OH	OVERHEAD			17%	$3,429			$1,172	$4,601
33	PRO	PROFIT			10%	$2,384			$815	$3,198
34	CONT	CONTINGENCY			20%	$5,245			$1,792	$7,037
35	**TOTAL COST**		-	-	-	$31,467	-	-	$10,753	$42,220

ENGINEER'S OPINION OF PROBABLE COST

PROJECT	Fort Riley Feasibility Study for HVAC Upgrade	**SHEET** 1	**OF** 1
ENGINEER	E M C Engineers, Inc.	**DATE PREPARED**	4-May-95
	Denver, CO	**ESTIMATOR**	C. Wohlert
		CHECKED BY	A. Niemeyer

Line No.	Item Refer Code	Item Description	Unit of Measure	MATERIAL COST Quantity	MATERIAL COST Unit Cost	MATERIAL COST Total	LABOR COST Crew/ Worker	LABOR COST Hours/ Unit	LABOR COST Total	TOTAL
1		**BUILDING 6620**								
2		**NON-RECURRING**								
3										
4		*EXISTING SYSTEM REPLACEMENT*								
5	AHUH10000	10,000 CFM AHU	EA.	2.0	$5,784.93	$11,570	Q-6	46.67	$1,877	$13,446
6	STLPIP2.5	STEEL PIPE SCH. 40, 2.5" W/HANGERS	L.F.	120.0	$5.28	$634	Q-15	0.34	$791	$1,425
7		FITTINGS, 5%				$32			$40	$71
8	E-TSTAT1	SINGLE SETPOINT ELEC. TSTAT, 3 WIRE	EA.	2.0	$24.23	$48	1-ELEC	0.8	$33	$82
9	WIRE#12	COPPER WIRING #12	C.L.F.	1.5	$7.41	$11	1-ELEC	0.73	$23	$34
10	CNTV2	CONTROL VALVE 2"	EA.	4.0	$397.29	$1,589	1-PLUM	0.889	$77	$1,666
11	INSLPIP2.5	2.5" FIBERGLASS PIPE INSULATION, 1.5" THCK	L.F.	120.0	$1.60	$192	Q-14	0.089	$197	$389
12	DUCT500	GAL. STEEL DUCTWORK, 200 TO 500 LB.	LB.	350.0	$0.47	$163	Q-10	0.098	$666	$829
13	DTINSL2"	DUCT INSLULATION, 2" THICK	S.F.	250.0	$0.83	$208	Q-14	0.053	$244	$452
14										
15										
16										
17										
18										
19										
20										
21										
22										
23										
24										
25										
26										
27		*EXISTING SYSTEMS DEMOLITION*								
28		AHU DEMO	TON	3.7			Q-5	17.778	$1,275	$1,275
29										
30										
31		**SUBTOTAL**				$14,447			$5,223	$19,670
32	OH	OVERHEAD			17%	$2,427			$877	$3,304
33	PRO	PROFIT			10%	$1,687			$610	$2,297
34	CONT	CONTINGENCY			20%	$3,712			$1,342	$5,054
35	**TOTAL COST**		-	-	-	$22,274	-	-	$8,052	$30,326

ENGINEER'S OPINION OF PROBABLE COST

PROJECT	Fort Riley Feasibility Study for HVAC Upgrade	SHEET 1 OF 1	
ENGINEER	E M C Engineers, Inc.	DATE PREPARED	2-Mar-95
	Denver, CO	ESTIMATOR	C. Wohlert
		CHECKED BY	A. Niemeyer

Line No.	Item Refer Code	Item Description	Unit of Measure	MATERIAL COST Quantity	MATERIAL COST Unit Cost	MATERIAL COST Total	LABOR COST Crew/ Worker	LABOR COST Hours/ Unit	LABOR COST Total	TOTAL
1		**BUILDING 6620**								
2		***ANNUAL RECURRING***								
3		***ANNUAL MAINTENANCE COST - BASELINE***								
4										
5										
6										
7										
8										
9										
10										
11										
12										
13										
14										
15	**TOTAL ANNUAL MAINTENANCE COST - BASELINE**		-	-	-	$0	-	-	$0	$0
16										
17		***ANNUAL MAINTENANCE COST - NEW HVAC REPLACEMENT***								
18										
19										
20										
21										
22										
23										
24										
25										
26										
27										
28										
29	**TOTAL ANNUAL MAINTENANCE COST - BASELINE**		-	-	-	$0	-	-	$0	$0
30										
31										
32										
33										
34										
35	**TOTAL ANNUAL MAINTENANCE COST SAVINGS**		-	-	-	$0	-	-	$0	$0

DEMAND LIMITING ANALYSIS BUILDING 6620B

SUMMER PEAK (KW) = 27812	1993 JUL BILL 7/1-8/2 ACTUAL	1993 AUG BILL 8/2-9/1 ACTUAL	1993 SEP BILL 9/3-10/1 ACTUAL	1993 OCT BILL 10/1-11/1 ACTUAL	1993 NOV BILL 11/1-12/1 ACTUAL	1993 DEC BILL 12/1-1/3 ACTUAL	1993 JAN BILL 1/4-2/1 ACTUAL	1993 FEB BILL 2/1-3/1 ACTUAL	1993 MAR BILL 3/3-4/1 ACTUAL	1993 APR BILL 4/1-5/3 ACTUAL	1993 MAY BILL 5/3-6/1 ACTUAL	1993 JUN BILL 6/1-7/1 ACTUAL
BASE CASE												
CAPACITY (KW)	32472	34452	26136	20754	26400	22752	27108	25812	23310	21834	21996	30096
POWER FACTOR (%)	99.20%	99.10%	99.10%	99.90%	99.80%	99.70%	99.50%	99.60%	99.60%	99.80%	99.60%	98.80%
CAPACITY (KVA)	32734	34765	26373	20775	26453	22820	27244	25916	23404	21878	22084	30462
80% SUMMER PEAK (KVA)	27812	27812	27812	27812	27812	27812	27812	27812	27812	27812	27812	27812
CONTRACT MINIMUM (KVA)	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643
BILLING CAPACITY (KVA)	32734	34765	27812	27812	27812	27812	27812	27812	27812	27812	27812	30462
ACTUAL OR 80% PEAK	ACTUAL	ACTUAL	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	ACTUAL
200 KVA @ $4.45	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00
NEXT 400 @ $4.25	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00
REMAINING @ $4.05	$130,142.18	$138,367.78	$110,208.22	$110,208.22	$110,208.22	$110,208.22	$110,208.22	$110,208.22	$110,208.22	$110,208.22	$110,208.22	$120,939.23
SUB DISCOUNT $.20	($6,546.77)	($6,952.98)	($5,562.38)	($5,562.38)	($5,562.38)	($5,562.38)	($5,562.38)	($5,562.38)	($5,562.38)	($5,562.38)	($5,562.38)	($6,092.31)
CAPACITY CHARGE	$126,185.40	$134,004.80	$107,235.84	$107,235.84	$107,235.84	$107,235.84	$107,235.84	$107,235.84	$107,235.84	$107,235.84	$107,235.84	$117,436.92
TOTAL ENERGY (KWH)	16,920,000	16,200,000	10,980,000	10,140,000	11,160,000	12,930,000	12,600,000	12,270,000	12,480,000	11,070,000	9,720,000	13,170,000
50*KVA @ $.03924	$64,223.85	$68,208.70	$54,566.96	$54,566.96	$54,566.96	$54,566.96	$54,566.96	$54,566.96	$54,566.96	$54,566.96	$54,566.96	$59,765.54
100*KVA @ $.03404	$111,426.10	$118,339.66	$94,671.73	$94,671.73	$94,671.73	$94,671.73	$94,671.73	$94,671.73	$94,671.73	$94,671.73	$94,671.73	$103,691.08
250*KVA @ $.03084	$252,378.15	$268,037.26	$209,965.32	$184,059.72	$214,429.80	$214,429.80	$214,429.80	$214,429.80	$214,429.80	$212,740.92	$171,106.92	$234,858.46
EXCESS @ $.02864	$109,589.57	$65,701.49	$0.00	$0.00	$1,009.19	$51,701.99	$42,250.79	$32,799.59	$38,813.99	$0.00	$0.00	$28,221.42
ENERGY CHARGE	$537,617.67	$520,287.11	$359,204.01	$333,298.41	$364,677.69	$415,370.49	$405,919.29	$396,468.09	$402,482.49	$361,979.61	$320,345.61	$426,536.49
TOTAL CHARGE LESS ECA	$663,803.07	$654,291.92	$466,439.85	$440,534.25	$471,913.53	$522,606.33	$513,155.13	$503,703.93	$509,718.33	$469,215.45	$427,581.45	$543,973.42
DEMAND REDUCTION (KW)	**10.75**	**9.56**	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**13.32**
CAPACITY (KW)	32461	34442	26136	20754	26400	22752	27108	25812	23310	21834	21996	30083
POWER FACTOR (%)	99.20%	99.10%	99.10%	99.90%	99.80%	99.70%	99.50%	99.60%	99.60%	99.80%	99.60%	98.80%
CAPACITY (KVA)	32723	34755	26373	20775	26453	22820	27244	25916	23404	21878	22084	30448
80% SUMMER PEAK (KVA)	27804	27804	27804	27804	27804	27804	27804	27804	27804	27804	27804	27804
CONTRACT MINIMUM (KVA)	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643	14643
BILLING CAPACITY (KVA)	32723	34755	27804	27804	27804	27804	27804	27804	27804	27804	27804	30448
ACTUAL OR 80% PEAK	ACTUAL	ACTUAL	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	80% PEAK	ACTUAL
200 KVA @ $4.45	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00	$890.00
NEXT 400 @ $4.25	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00	$1,700.00
REMAINING @ $4.05	$130,098.28	$138,328.70	$110,176.96	$110,176.96	$110,176.96	$110,176.96	$110,176.96	$110,176.96	$110,176.96	$110,176.96	$110,176.96	$120,884.62
SUB DISCOUNT $.20	($6,544.61)	($6,951.05)	($5,560.84)	($5,560.84)	($5,560.84)	($5,560.84)	($5,560.84)	($5,560.84)	($5,560.84)	($5,560.84)	($5,560.84)	($6,089.61)
CAPACITY CHARGE	$126,143.67	$133,967.65	$107,206.12	$107,206.12	$107,206.12	$107,206.12	$107,206.12	$107,206.12	$107,206.12	$107,206.12	$107,206.12	$117,385.01
TOTAL ENERGY (KWH)	16,920,000	16,200,000	10,980,000	10,140,000	11,160,000	12,930,000	12,600,000	12,270,000	12,480,000	11,070,000	9,720,000	13,170,000
50*KVA @ $.03924	$64,202.59	$68,189.77	$54,551.81	$54,551.81	$54,551.81	$54,551.81	$54,551.81	$54,551.81	$54,551.81	$54,551.81	$54,551.81	$59,739.08
100*KVA @ $.03404	$111,389.20	$118,306.81	$94,645.45	$94,645.45	$94,645.45	$94,645.45	$94,645.45	$94,645.45	$94,645.45	$94,645.45	$94,645.45	$103,645.18
250*KVA @ $.03084	$252,294.57	$267,962.85	$210,001.03	$184,095.43	$214,370.28	$214,370.28	$214,370.28	$214,370.28	$214,370.28	$212,776.63	$171,142.63	$234,754.50
EXCESS @ $.02864	$109,713.75	$65,812.05	$0.00	$0.00	$1,097.64	$51,790.44	$42,339.24	$32,888.04	$38,902.44	$0.00	$0.00	$28,375.89
ENERGY CHARGE	$537,600.11	$520,271.48	$359,198.30	$333,292.70	$364,665.18	$415,357.98	$405,906.78	$396,455.58	$402,469.98	$361,973.90	$320,339.90	$426,514.65
TOTAL CHARGE LESS ECA	$663,743.78	$654,239.13	$466,404.42	$440,498.82	$471,871.30	$522,564.10	$513,112.90	$503,661.70	$509,676.10	$469,180.02	$427,546.02	$543,899.65
SUMMARY												
MONTHLY DIFFERENCE	$59.29	$52.79	$35.44	$35.44	$42.23	$42.23	$42.23	$42.23	$42.23	$35.44	$35.44	$73.76
ANNUAL DIFFERENCE.............		**$538.74**										

REPORT- LV-D DETAILS OF EXTERIOR SURFACES IN THE PROJECT

NUMBER OF EXTERIOR SURFACES 6 RECTANGULAR 6 OTHER 0
(U-VALUE INCLUDES INSIDE AIR FILM PLUS OUTSIDE AIR FILM AT 7.5 MPH WINDSPEED)

SURFACE	SPACE	- - - - G L A S S - - - - U-VALUE (BTU/HR-SQFT-F)	AREA (SQFT)	- - - - W A L L - - - - U-VALUE (BTU/HR-SQFT-F)	AREA (SQFT)	- W A L L + G L A S S - U-VALUE (BTU/HR-SQFT-F)	AREA (SQFT)	AZIMUTH
NORTH-WALL	SPACE_1	1.021	468.00	0.118	1714.50	0.312	2182.50	NORTH
EAST-WALL	SPACE_1	0.000	0.00	0.118	1242.00	0.118	1242.00	NORTH-EAST
SOUTH-WALL	SPACE_1	1.021	244.00	0.118	1331.00	0.258	1575.00	SOUTH-EAST
WEST-WALL	SPACE_1	1.021	97.00	0.118	1361.00	0.178	1458.00	SOUTH-WEST
	SPACE_1	0.000	0.00	0.094	2425.00	0.094	2425.00	ROOF
	SPACE_1	0.000	0.00	0.094	3395.00	0.094	3395.00	ROOF
	SPACE_1	0.000	0.00	0.020	4590.00	0.020	4590.00	UNDERGRND

EMC ENGINEERS INC. EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/18/1995 10:19:55 LDL RUN 1
DENVER, CO 80227 EXISTING CONDITION OF BLDG. 6620 COMMUN ACT CTR TOPEKA, KS
REPORT- LV-D DETAILS OF EXTERIOR SURFACES IN THE PROJECT

	AVERAGE U-VALUE/GLASS (BTU/HR-SQFT-F)	AVERAGE U-VALUE/WALLS (BTU/HR-SQFT-F)	AVERAGE U-VALUE WALLS+GLASS (BTU/HR-SQFT-F)	GLASS AREA (SQFT)	OPAQUE AREA (SQFT)	GLASS+OPAQUE AREA (SQFT)
NORTH	1.021	0.118	0.312	468.00	1714.50	2182.50
NORTH-EAST	0.000	0.118	0.118	0.00	1242.00	1242.00
SOUTH-EAST	1.021	0.118	0.258	244.00	1331.00	1575.00
SOUTH-WEST	1.021	0.118	0.178	97.00	1361.00	1458.00
ROOF	0.000	0.094	0.094	0.00	5820.00	5820.00
ALL WALLS	1.021	0.118	0.231	809.00	5648.50	6457.50
WALLS+ROOFS	1.021	0.106	0.166	809.00	11468.50	12277.50
UNDERGRND	0.000	0.020	0.020	0.00	4590.00	4590.00
BUILDING	1.021	0.081	0.126	809.00	16058.50	16867.50

REPORT- LS-C BUILDING PEAK LOAD COMPONENTS

*** BUILDING ***

FLOOR AREA	4590	SQFT	426	SQMT
VOLUME	123930	CUFT	3510	CUMT

	COOLING LOAD				HEATING LOAD	
TIME	JUL 23	4PM			JAN 4	3AM
DRY-BULB TEMP	98F	37C			8F	-13C
WET-BULB TEMP	79F	26C			7F	-14C
	SENSIBLE		LATENT		SENSIBLE	
	(KBTU/H)	(KW)	(KBTU/H)	(KW)	(KBTU/H)	(KW)
WALLS	8.170	2.393	0.000	0.000	-31.018	-9.084
ROOFS	12.808	3.751	0.000	0.000	-32.144	-9.414
GLASS CONDUCTION	22.230	6.511	0.000	0.000	-62.587	-18.330
GLASS SOLAR	9.508	2.785	0.000	0.000	0.436	0.128
DOOR	0.776	0.227	0.000	0.000	-1.512	-0.443
INTERNAL SURFACES	0.000	0.000	0.000	0.000	0.000	0.000
UNDERGROUND SURFACES	-0.824	-0.241	0.000	0.000	-2.636	-0.772
OCCUPANTS TO SPACE	6.543	1.916	9.375	2.746	0.188	0.055
LIGHT TO SPACE	30.393	8.901	0.000	0.000	4.408	1.291
EQUIPMENT TO SPACE	0.000	0.000	0.000	0.000	0.000	0.000
PROCESS TO SPACE	0.000	0.000	0.000	0.000	0.000	0.000
INFILTRATION	12.063	3.533	17.769	5.204	-57.812	-16.932
TOTAL	101.666	29.775	27.144	7.950	-182.676	-53.501
TOTAL LOAD	128.810 KBTU/H		37.725 KW		-182.676 KBTU/H	-53.501 KW
TOTAL LOAD / AREA	28.06BTU/H.SQFT		88.469 W /SQMT		39.799BTU/H.SQFT	125.464 W /SQMT

NOTE 1) THE ABOVE LOADS EXCLUDE OUTSIDE VENTILATION AIR LOADS
---- 2) TIMES GIVEN IN STANDARD TIME FOR THE LOCATION IN CONSIDERATION

EMC ENGINEERS INC. EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/18/1995 10:19:55 SDL RUN 1
DENVER, CO 80227 EXISTING CONDITION OF BLDG. 6620 COMMUN ACT CTR
REPORT- SS-A SYSTEM MONTHLY LOADS SUMMARY FOR AC-1 TOPEKA, KS

	COOLING						HEATING						ELEC	
MONTH	COOLING ENERGY (MBTU)	TIME OF MAX DY	TIME OF MAX HR	DRY-BULB TEMP	WET-BULB TEMP	MAXIMUM COOLING LOAD (KBTU/HR)	HEATING ENERGY (MBTU)	TIME OF MAX DY	TIME OF MAX HR	DRY-BULB TEMP	WET-BULB TEMP	MAXIMUM HEATING LOAD (KBTU/HR)	ELEC-TRICAL ENERGY (KWH)	MAXIMUM ELEC LOAD (KW)
JAN	0.00000					0.000	-129.618	15	3	-8.F	-9.F	-315.139	8129.	16.100
FEB	0.00000					0.000	-98.363	3	6	-1.F	-2.F	-281.197	7343.	16.100
MAR	0.00000					0.000	-81.238	3	4	16.F	13.F	-246.230	8129.	16.100
APR	0.00000					0.000	-28.455	5	6	31.F	28.F	-156.429	7867.	16.100
MAY	21.83395	30	10	73.F	69.F	184.775	-6.333	5	5	44.F	40.F	-102.709	8129.	16.100
JUN	65.69810	19	10	82.F	74.F	255.430	0.000					0.000	7867.	16.100
JUL	91.95013	24	10	80.F	75.F	276.244	0.000					0.000	8129.	16.100
AUG	88.62517	21	10	86.F	76.F	281.655	0.000					0.000	8129.	16.100
SEP	40.21316	5	10	75.F	72.F	223.035	0.000					0.000	7867.	16.100
OCT	0.24352	1	17	85.F	68.F	62.325	-24.275	20	6	24.F	23.F	-162.492	8129.	16.100
NOV	0.00000					0.000	-63.838	2	6	15.F	14.F	-212.703	7867.	16.100
DEC	0.00000					0.000	-117.079	15	5	8.F	7.F	-284.457	8129.	16.100
TOTAL	308.564						-549.198						95727.	
MAX						281.655						-315.139		16.100

EMC ENGINEERS INC. EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/18/1995 10:19:55 SDL RUN 1
DENVER, CO 80227 EXISTING CONDITION OF BLDG. 6620 COMMUN ACT CTR
REPORT- SS-C SYSTEM MONTHLY LOAD HOURS FOR AC-1 TOPEKA, KS

	NUMBER OF HOURS										COINCIDENT LOADS	
MONTH	HOURS COOLING LOAD	HOURS HEATING LOAD	HOURS COINCIDENT COOL-HEAT LOAD	HOURS FLOATING	HOURS HEATING AVAIL.	HOURS COOLING AVAIL.	HOURS FANS ON	HOURS FANS CYCLE ON	HOURS NIGHT VENTING	HOURS FLOATING WHEN FANS ON	HEATING LOAD AT COOLING PEAK (KBTU/HR)	ELECTRIC LOAD AT COOLING PEAK (KW)
JAN	0	744	0	0	744	0	744	0	0	0	-155.028	6.006
FEB	0	672	0	0	672	0	672	0	0	0	-152.858	6.006
MAR	0	735	0	9	744	0	744	0	0	9	-154.266	6.006
APR	0	588	0	132	720	0	720	0	0	132	-51.691	6.006
MAY	325	250	0	169	360	325	744	0	0	169	0.000	16.100
JUN	675	0	0	45	0	676	720	0	0	45	0.000	16.100
JUL	744	0	0	0	0	744	744	0	0	0	0.000	16.100
AUG	739	0	0	5	0	739	744	0	0	5	0.000	16.100
SEP	487	0	0	233	0	491	720	0	0	233	0.000	16.100
OCT	6	559	0	179	720	6	744	0	0	179	0.000	16.100
NOV	0	682	0	38	720	0	720	0	0	38	-175.796	6.006
DEC	0	744	0	0	744	0	744	0	0	0	-173.680	6.006
ANNUAL	2976	4974	0	810	5424	2981	8760	0	0	810		

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EMC       ENGINEERS      INC.        EZDOE - ELITE SOFTWARE DEVELOPMENT INC          DOE-2.1D   2/18/1995     10:19:55  PDL RUN 1
DENVER,      CO          80227       EXISTING CONDITION OF BLDG. 6620         COMMUN ACT CTR
REPORT- PS-B  MONTHLY PEAK AND TOTAL ENERGY USE                                      TOPEKA, KS
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MO	UTILITY-	ELECTRICITY	NATURAL-GAS
	TOTAL(MBTU)	34.207	178.954
JAN	PEAK(KBTU)	63.692	395.890
	DY/HR	31/17	15/ 3
	TOTAL(MBTU)	30.847	140.420
FEB	PEAK(KBTU)	63.692	359.974
	DY/HR	28/13	3/ 6
	TOTAL(MBTU)	33.620	120.513
MAR	PEAK(KBTU)	63.692	322.218
	DY/HR	31/16	3/ 4
	TOTAL(MBTU)	30.041	45.762
APR	PEAK(KBTU)	63.692	221.743
	DY/HR	17/ 7	5/ 6
	TOTAL(MBTU)	38.573	10.928
MAY	PEAK(KBTU)	128.126	159.225
	DY/HR	31/16	5/ 5
	TOTAL(MBTU)	53.673	0.000
JUN	PEAK(KBTU)	137.835	0.000
	DY/HR	19/10	30/ 1
	TOTAL(MBTU)	63.026	0.000
JUL	PEAK(KBTU)	151.130	0.000
	DY/HR	23/16	31/ 1
	TOTAL(MBTU)	63.397	0.000
AUG	PEAK(KBTU)	145.941	0.000
	DY/HR	21/10	31/ 1
	TOTAL(MBTU)	44.122	0.000
SEP	PEAK(KBTU)	139.721	0.000
	DY/HR	6/16	30/ 1
	TOTAL(MBTU)	30.877	39.963
OCT	PEAK(KBTU)	87.126	228.686
	DY/HR	1/17	20/ 6
	TOTAL(MBTU)	31.919	96.396
NOV	PEAK(KBTU)	63.692	285.297
	DY/HR	30/17	2/ 6
	TOTAL(MBTU)	34.155	164.618
DEC	PEAK(KBTU)	63.692	363.455
	DY/HR	31/17	15/ 5
	ONE YEAR	488.456	797.554
	USE/PEAK	151.130	395.890

ENERGY TYPE IN SITE MBTU - CATEGORY OF USE	ELECTRICITY	NATURAL-GAS
SPACE HEAT	27.99	797.55
SPACE COOL	110.94	0.00
HVAC AUX	202.37	0.00
DOM HOT WTR	0.00	0.00
AUX SOLAR	0.00	0.00
LIGHTS	147.18	0.00
VERT TRANS	0.00	0.00
MISC EQUIP	0.00	0.00
TOTAL	488.48	797.55

TOTAL SITE ENERGY 1286.01 MBTU 280.2 KBTU/SQFT-YR GROSS-AREA 280.2 KBTU/SQFT-YR NET-AREA
TOTAL SOURCE ENERGY 2264.39 MBTU 493.3 KBTU/SQFT-YR GROSS-AREA 493.3 KBTU/SQFT-YR NET-AREA
PERCENT OF HOURS ANY SYSTEM ZONE OUTSIDE OF THROTTLING RANGE = 0.0
PERCENT OF HOURS ANY PLANT LOAD NOT SATISFIED = 0.0
NOTE ELECTRICITY AND/OR FUEL USED TO GENERATE ELECTRICITY IS APPORTIONED BASED ON THE YEARLY DEMAND. ALL OTHER ENERGY TYPES ARE APPORTIONED HOURLY.

EMC ENGINEERS INC. EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/23/1995 8:21: 1 SDL RUN 1
DENVER, CO 80227 PROPOSED MODIFICATION OF BLDG. 6620 COMMUN ACT CTR
REPORT- SS-A SYSTEM MONTHLY LOADS SUMMARY FOR AC-1 TOPEKA, KS

MONTH	COOLING: COOLING ENERGY (MBTU)	COOLING: TIME OF MAX DY	COOLING: TIME OF MAX HR	COOLING: DRY-BULB TEMP	COOLING: WET-BULB TEMP	COOLING: MAXIMUM COOLING LOAD (KBTU/HR)	HEATING: HEATING ENERGY (MBTU)	HEATING: TIME OF MAX DY	HEATING: TIME OF MAX HR	HEATING: DRY-BULB TEMP	HEATING: WET-BULB TEMP	HEATING: MAXIMUM HEATING LOAD (KBTU/HR)	ELEC: ELEC-TRICAL ENERGY (KWH)	ELEC: MAXIMUM ELEC LOAD (KW)
JAN	0.00000					0.000	-110.152	15	4	-8.F	-9.F	-224.370	3948.	10.480
FEB	0.00000					0.000	-89.834	3	7	-5.F	-6.F	-212.565	3566.	10.480
MAR	0.00000					0.000	-77.309	4	6	14.F	12.F	-176.480	3948.	10.480
APR	0.00000					0.000	-32.112	5	6	31.F	28.F	-142.470	4050.	18.478
MAY	14.97177	31	16	88.F	75.F	147.524	-8.234	5	6	44.F	40.F	-99.384	4396.	18.478
JUN	45.36160	19	10	82.F	74.F	221.779	0.000					0.000	4184.	13.486
JUL	65.09155	24	10	80.F	75.F	252.704	0.000					0.000	4584.	14.790
AUG	64.76651	21	10	86.F	76.F	257.348	0.000					0.000	4672.	14.843
SEP	29.01475	6	16	93.F	76.F	189.833	0.000					0.000	4007.	14.061
OCT	0.54035	1	17	85.F	68.F	50.445	-28.095	20	6	24.F	23.F	-151.866	4234.	18.478
NOV	0.00000					0.000	-63.147	3	5	13.F	12.F	-174.640	3851.	16.208
DEC	0.00000					0.000	-102.217	13	8	0.F	-1.F	-204.223	3948.	10.480
TOTAL	219.746						-511.100						49391.	
MAX						257.348						-224.370		18.478

D11-25

EMC ENGINEERS INC. EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/23/1995 8:21: 1 SDL RUN 1
DENVER, CO 80227 PROPOSED MODIFICATION OF BLDG. 6620 COMMUN ACT CTR
REPORT- SS-C SYSTEM MONTHLY LOAD HOURS FOR AC-1 TOPEKA, KS

MONTH	NUMBER OF HOURS: HOURS COOLING LOAD	HOURS HEATING LOAD	HOURS COINCIDENT COOL-HEAT LOAD	HOURS FLOATING	HOURS HEATING AVAIL.	HOURS COOLING AVAIL.	HOURS FANS ON	HOURS FANS CYCLE ON	HOURS NIGHT VENTING	HOURS FLOATING WHEN FANS ON	COINCIDENT LOADS: HEATING LOAD AT COOLING PEAK (KBTU/HR)	COINCIDENT LOADS: ELECTRIC LOAD AT COOLING PEAK (KW)
JAN	0	744	0	0	744	0	744	0	0	0	-139.871	0.386
FEB	0	672	0	0	672	0	672	0	0	0	-141.597	0.386
MAR	0	744	0	0	744	0	744	0	0	0	-139.832	0.386
APR	0	642	0	78	720	0	720	0	0	78	-55.551	0.386
MAY	383	262	0	99	360	384	744	0	0	99	0.000	12.577
JUN	720	0	0	0	0	720	720	0	0	0	0.000	13.486
JUL	744	0	0	0	0	744	744	0	0	0	0.000	14.514
AUG	744	0	0	0	0	744	744	0	0	0	0.000	14.578
SEP	668	0	0	52	0	720	720	0	0	52	0.000	14.061
OCT	19	600	0	125	720	24	744	0	0	125	0.000	10.480
NOV	0	706	0	14	720	0	720	0	0	14	-152.185	0.386
DEC	0	744	0	0	744	0	744	0	0	0	-147.887	0.386
ANNUAL	3278	5114	0	368	5424	3336	8760	0	0	368		

MO	UTILITY-	ELECTRICITY	NATURAL-GAS
	TOTAL(MBTU)	18.100	147.916
JAN	PEAK(KBTU)	41.991	281.863
	DY/HR	31/17	15/ 4
	TOTAL(MBTU)	16.339	122.848
FEB	PEAK(KBTU)	41.991	269.436
	DY/HR	28/17	3/ 7
	TOTAL(MBTU)	17.935	109.717
MAR	PEAK(KBTU)	41.991	230.686
	DY/HR	31/17	4/ 6
	TOTAL(MBTU)	16.753	49.647
APR	PEAK(KBTU)	63.093	193.118
	DY/HR	28/16	5/ 6
	TOTAL(MBTU)	24.366	13.556
MAY	PEAK(KBTU)	104.965	144.061
	DY/HR	31/16	5/ 6
	TOTAL(MBTU)	35.462	0.000
JUN	PEAK(KBTU)	119.661	0.000
	DY/HR	19/10	30/ 1
	TOTAL(MBTU)	42.855	0.000
JUL	PEAK(KBTU)	136.462	0.000
	DY/HR	23/16	31/ 1
	TOTAL(MBTU)	43.923	0.000
AUG	PEAK(KBTU)	132.895	0.000
	DY/HR	21/10	31/ 1
	TOTAL(MBTU)	29.077	0.000
SEP	PEAK(KBTU)	123.224	0.000
	DY/HR	6/16	30/ 1
	TOTAL(MBTU)	17.561	44.215
OCT	PEAK(KBTU)	63.506	203.598
	DY/HR	1/17	20/ 6
	TOTAL(MBTU)	17.132	91.001
NOV	PEAK(KBTU)	55.342	228.680
	DY/HR	23/14	3/ 5
	TOTAL(MBTU)	18.098	139.052
DEC	PEAK(KBTU)	41.991	260.580
	DY/HR	31/17	13/ 8
	ONE YEAR	297.602	717.952
	USE/PEAK	136.462	281.863

ENERGY TYPE IN SITE MBTU - CATEGORY OF USE	ELECTRICITY	NATURAL-GAS
SPACE HEAT	22.12	717.95
SPACE COOL	86.39	0.00
HVAC AUX	41.91	0.00
DOM HOT WTR	0.00	0.00
AUX SOLAR	0.00	0.00
LIGHTS	147.18	0.00
VERT TRANS	0.00	0.00
MISC EQUIP	0.00	0.00
TOTAL	297.61	717.95

TOTAL SITE ENERGY 1015.55 MBTU 221.3 KBTU/SQFT-YR GROSS-AREA 221.3 KBTU/SQFT-YR NET-AREA
TOTAL SOURCE ENERGY 1611.65 MBTU 351.1 KBTU/SQFT-YR GROSS-AREA 351.1 KBTU/SQFT-YR NET-AREA
PERCENT OF HOURS ANY SYSTEM ZONE OUTSIDE OF THROTTLING RANGE = 17.4
PERCENT OF HOURS ANY PLANT LOAD NOT SATISFIED = 0.0
NOTE ELECTRICITY AND/OR FUEL USED TO GENERATE ELECTRICITY IS APPORTIONED BASED ON THE YEARLY DEMAND. ALL OTHER ENERGY TYPES ARE APPORTIONED HOURLY.

APPENDIX E

COMPUTER SIMULATION PROGRAM

EZDOE - Commercial Building Energy Analysis (DOE): The EZDOE program is an easy to use IBM PC compatible version of the U.S. Department of Energy (DOE) program known as DOE-2.1. EZDOE calculates the hourly energy use of a building and its life cycle cost of operation given information on the building's location, construction, operation, and heating and air conditioning system. Using hourly weather data and algorithms developed by Lawrence Berkeley Laboratory, EZDOE is a dynamic program that takes into account complex thermal storage effects of various building materials. In addition, EZDOE can also accurately simulate the operation of all types of heating and cooling plants including ice water thermal storage and cogeneration systems. Up to 22 different air handling systems each with multiple control options are supported. The types of heating and cooling plants allowed is nearly infinite as thousands of combinations of chillers, boilers, furnaces, pumps, and cooling towers are allowed. There is even provision for user defined plants and performance curves.

EXECUTIVE SUMMARY

DOE-2 enables architects and engineers to compute energy consumption in buildings. The program can simulate hour-by-hour performance of a building for each of the 8760 hours in a year. A new computer language, the Building Description Language, has been written. It is a computer language for analysis of building energy consumption that permits the user to instruct a computer in familiar English terminology.

Building Description Language has been developed primarily to aid engineers and architects in the difficult and time-consuming task of designing energy-efficient buildings that have low life-cycle cost. The energy consumption of a building is determined by its shape; the thermal properties of materials; the size and position of walls, floors, roofs, windows, and doors; and the transient effects of shading, occupancy patterns, lighting schedules, equipment operation, ambient conditions, and temperature and humidity controls. Energy consumption is affected, also, by the operation of primary and secondary HVAC systems and by the type and efficiency of the fuel conversion (plant) equipment. Furthermore, the life-cycle cost of operating a building under different economic constraints can strongly influence basic design decisions.

DOE-2 also provides a means of performing the complicated analysis of energy consumption without the necessity of instructing the program correctly in every minor detail. A set of default values (numbers used for the value of a variable if the user does not assign one) is included, to reduce the amount of input that must be supplied in order to run the program.

BDL Processor

The BDL Processor sequentially checks each BDL instruction for proper form, syntax, and content. The BDL Processor also checks for values that are beyond the expected range for input variables. As stated before, if a value is not specified, the BDL processor assigns an assumed (default) value, which will appear in the listing of input data. Sometimes the default value is actually a set of default values, such as a performance curve for a piece of equipment. It is possible for the user to override this set of default values (performance curve) with a different set of default values. The BDL Processor also collects whatever data the user desires from the various permanent libraries, e.g., data from the Materials Library. Response factors, numbers that are used to determine the transient flow of heat through exterior walls and roofs as they react to randomly fluctuating climatic conditions, are also calculated by the BDL Processor for use by the LOADS and SYSTEMS programs. The BDL processor will calculate, if desired, Custom Weighting Factors and build user-designed libraries of materials and walls. These factors are intended to account for the thermal lag in the heating and cooling of furnishings and structures. The BDL Processor also prepares the input data files for use by the LOADS, SYSTEMS, PLANT, or ECONOMICS (LSPE) simulators.

It is important to recognize that each of the LSPE simulators depends on the results of some or all of the previous simulators, and that many variations and combinations are allowed. Each of the LSPE simulators can be run repeatedly, to study the effect of design variations. Superior energy-efficient building design can result in greatly reduced energy consumption and

significantly lower life-cycle cost.

LOADS Program

The LOADS program simulator calculates the hourly heating and cooling loads, using primarily the algorithms described in Ref. 1, "Procedure for Determining Heating and Cooling Loads for Computerizing Energy Calculations, Algorithms for Building Heat Transfer Subroutines," available from the American Society of Heating, Refrigerating, and Air Conditioning Engineers, Inc. (ASHRAE). DOE-2 provides a reorganization and reprogramming of many of these algorithms to increase execution speed. A description of the BDL input for the LOADS program (LDL) is presented in Chap. III, and a detailed description of the LOADS simulator is given in the Engineers Manual.

In the LOADS program (simulator), the heat gains and losses through walls, roofs, floors, windows, and doors are calculated separately. Heat transfer by conduction and radiation through the building skin is computed, using response factors, considering the effects of the thermal mass, placement of insulation, sun angle, cloud cover, and building location, orientation, and architectural features. Every set of response factors generated is placed in a file to be used by the LOADS and SYSTEMS programs. Infiltration loads can be calculated on the basis of the difference between the inside and outside conditions and on an assumed leak rate (crack method) or by an air-change method.

Internal use of energy for lighting and equipment is also computed according to schedules assigned by the user for each piece of equipment that affects the energy balance of each space. The latent and sensible heat given off by the building occupants is calculated as an hour-by-hour function of the occupancy of the building.

All the LOADS computations are performed on the basis of a fixed temperature for each space as specified by the user. Because the LOADS program calculates thermal loads on the basis of hourly weather data but artificial (fixed) space temperatures, the output may have little bearing on the actual thermal requirements of a building. It is, instead, a baseline profile of the thermal performance of a space, given a fixed internal temperature. The SYSTEMS program then modifies the output of the LOADS program, to produce actual thermal loads based on a hourly variable internal temperature.

The output of LOADS is useful to architects who wish to examine the thermal behavior of various combinations of materials used to make up alternative exterior walls and roofs. However, it is expected that engineers will be interested in the predicted thermal demands on the physical plant (chillers and heaters), obtained by running both the LOADS and SYSTEMS programs.

SYSTEMS Program

The SYSTEMS program contains algorithms for simulating performance of the secondary HVAC equipment used to control the temperature and humidity of each zone within the building. Many of the equations used to develop the SYSTEMS simulation procedure are given in Refs. 1 and 2. These algorithms have been

organized and coded to allow selection of one of the preprogrammed space conditioning systems described in Chap. IV. The SYSTEMS program is used by choosing one of these preprogrammed systems and providing the necessary input data for the simulation calculations.

The SYSTEMS program uses the output information from the LOADS program and a list of user-defined system characteristics (e.g., air flow rates, thermostat settings, schedules of equipment operation, or temperature setback schedules) to calculate the hour-by-hour energy requirements of the secondary HVAC system. The SYSTEMS program calculates thermal loads based on variable temperature conditions for each zone.

PLANT Program

The PLANT program contains the equations necessary to calculate the performance of the primary energy conversion equipment. The operation of each plant component (e.g., boiler, absorption chiller, compression chiller, cooling tower, hot water storage tank, solar heater) is modeled on the basis of operating conditions and part-load performance characteristics. The user selects the type of plant equipment to be modeled (e.g., 2-stage absorption chiller), the size of each unit (e.g., 100 tons), the number of units, and the number of units simultaneously available. Values for equipment lifetime and maintenance may also be entered if preprogrammed values for these variables are not used. The sequence of equipment operation may be specified as a step function (e.g., from 0 to 500,000 Btu/hr, unit 1; from 500,001 to 10M Btu/hr, units 1 and 2). The user may schedule equipment operation by time (hourly or seasonally) or by peak load schedules. Additionally, the operating strategy between the various types of equipment may be specified. Energy storage may be specified. The PLANT program uses hourly results from the LOADS and SYSTEMS programs and the user's instructions to calculate the electrical and thermal energy consumption of the building. The DOE-2 PLANT program also contains subroutines for computing the life-cycle costs of plant equipment.

REPORT BEPS - ESTIMATED BUILDING ENERGY PERFORMANCE

The information in this report has been calculated and formatted to comply with the U.S. Department of Energy's Building Energy Performance Standards. The report makes it possible to review quickly the building performance as a function of site energy used (by type) per unit floor area. The breakdown of usage of up to five different types of energy sources is presented. These energy sources are user-specified through the ENERGY-COST and PLANT-PARAMETERS instructions.

HVAC auxiliary (shown as HVAC AUX) is defined as the energy required to operate non-solar fans, pumps, etc., which transport the conditioned air and water. AUX SOLAR is the energy required to operate the fans, pumps, etc. that transport the conditioned water or air associated with solar equipment. SPACE COOL and SPACE HEAT includes all equipment required to produce the conditioned water or air for SPACE heating or cooling.

Process and domestic hot water (shown as DOM HOT WTR) is the summation of the user input for hot water in the BUILDING-RESOURCE instruction and any entries for SOURCE-TYPE = HOT-WATER in the SPACE-CONDITIONS instruction.

Vertical transportation (shown as VERT TRANS) is the summary of energy for elevators and escalators input through the BUILDING-RESOURCE instruction.

Loads that are input through the SOURCE-TYPE = GAS or SOURCE-TYPE = ELECTRIC in the SPACE-CONDITIONS instruction will appear in this report as miscellaneous equipment (shown as MISC EQUIP). Loads entered as SOURCE-TYPE = PROCESS are assumed to have energy sources independent of the building utilities (i.e., wood stoves, acetylene welders, etc.) and are not reported in the BEPS report.

The distribution of ENERGY TYPE among the CATEGORY OF USE items is exact for every type of energy except electricity. Purchased electricity is apportioned correctly, but electricity generated on-site is apportioned on the basis of net yearly demands for electricity for each category.

It should also be pointed out that this report is not designed to work when there is a steam turbine among the specified plant equipment items. The numbers reported when a steam turbine is present will not be reliable.

The report of TOTAL SITE ENERGY and TOTAL SOURCE ENERGY provides a distinction between the energy used per gross square foot of building area and that used per net square foot of building area. The report generator takes the gross area from the keyword GROSS-AREA in the BUILDING-LOCATION instruction in LOADS. The default for this keyword is the net area, i.e., the sum of the floor areas of the CONDITIONED ZONEs.

When a hot storage tank is present, a note is printed on the BEPS report stating that the hot water storage tank can get energy from many sources. Any time there is residual energy in the storage tanks, the totals in the BEPS report will not agree with those in report PS-B, because the BEPS report includes only the energy used for the above categories, whereas PS-B includes the energy that is left in the tanks as well.

EMC ENGINEERS INC. EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/27/1995 16:44:58 L RUN 1
~~DENVER,~~ CO 80227 EXISTING CONDITION OF BLDG. 7612 ENL BARRACKS W/AS
REPORT- BEPS ESTIMATED BUILDING ENERGY PERFORMANCE EXAMPLE TOPEKA, KS

ENERGY TYPE IN SITE MBTU - CATEGORY OF USE	ELECTRICITY	NATURAL-GAS
SPACE HEAT	132.94	3450.29
SPACE COOL	427.44	0.00
HVAC AUX	267.62	0.00
DOM HOT WTR	0.00	0.00
AUX SOLAR	0.00	0.00
LIGHTS	612.35	0.00
VERT TRANS	0.00	0.00
MISC EQUIP	511.11	0.00
TOTAL	1951.46	3450.29

TOTAL SITE ENERGY 5401.73 MBTU 1364.1 KBTU/SQFT-YR GROSS-AREA 387.0 KBTU/SQFT-YR NET-AREA
TOTAL SOURCE ENERGY 9310.47 MBTU 2351.1 KBTU/SQFT-YR GROSS-AREA 667.0 KBTU/SQFT-YR NET-AREA
PERCENT OF HOURS ANY SYSTEM ZONE OUTSIDE OF THROTTLING RANGE = 17.0
PERCENT OF HOURS ANY PLANT LOAD NOT SATISFIED = 0.0
NOTE ELECTRICITY AND/OR FUEL USED TO GENERATE ELECTRICITY IS APPORTIONED BASED ON THE YEARLY DEMAND. ALL OTHER ENERGY TYPES ARE APPORTIONED HOURLY.

EMC ENGINEERS INC. EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 2/22/1995 11:34:22 PDL RUN 1
~~DENVER,~~ CO 80227 PROPOSED MODIFICATION FOR BLDG #7612 ENL MEN BARRACKS W/O DIN
REPORT- BEPS ESTIMATED BUILDING ENERGY PERFORMANCE TOPEKA, KS

ENERGY TYPE IN SITE MBTU - CATEGORY OF USE	ELECTRICITY	NATURAL-GAS
SPACE HEAT	44.63	1274.67
SPACE COOL	433.49	0.00
HVAC AUX	254.78	0.00
DOM HOT WTR	0.00	0.00
AUX SOLAR	0.00	0.00
LIGHTS	612.35	0.00
VERT TRANS	0.00	0.00
MISC EQUIP	511.10	0.00
TOTAL	1856.36	1274.67

TOTAL SITE ENERGY 3131.02 MBTU 74.8 KBTU/SQFT-YR GROSS-AREA 224.3 KBTU/SQFT-YR NET-AREA
TOTAL SOURCE ENERGY 6849.30 MBTU 163.6 KBTU/SQFT-YR GROSS-AREA 490.7 KBTU/SQFT-YR NET-AREA
PERCENT OF HOURS ANY SYSTEM ZONE OUTSIDE OF THROTTLING RANGE = 25.1
PERCENT OF HOURS ANY PLANT LOAD NOT SATISFIED = 0.1
NOTE ELECTRICITY AND/OR FUEL USED TO GENERATE ELECTRICITY IS APPORTIONED BASED ON THE YEARLY DEMAND. ALL OTHER ENERGY TYPES ARE APPORTIONED HOURLY.

FEMP Project No. 1

Upgrade HVAC Systems in Dental Clinics
Buildings 602, 7665, and 7670

1. COMPONENT ARMY	FY 1995 MILITARY CONSTRUCTION PROJECT DATA	2. DATE MAY 95

3. INSTALLATION AND LOCATION	4. PROJECT TITLE
Fort Riley, Kansas	Upgrade HVAC Systems in Dental Clinics

5. PROGRAM ELEMENT	6. CATEGORY CODE	7. PROJECT NUMBER	8. PROJECT COST ($000)

9. COST ESTIMATES

ITEM	U/M	QUANTITY	UNIT COST	COST ($000)
Upgrade HVAC Systems in Dental Clinics	LS			79
TOTAL CONTRACT COST				79
SIOH (5.5%)				4
DESIGN COST (6.0%)				5
TOTAL PROJECT COST				88
Total Request (Rounded)				90

10. DESCRIPTION OF PROPOSED CONSTRUCTION

The proposed construction consists of upgrading the HVAC systems in the dental clinics, Buildings 602, 7665, and 7670. The HVAC system upgrades include the following:

- Convert the existing dual duct air handling unit (AHU) serving Building 602 to a variable-air-volume (VAV) AHU. A variable speed drive (VSD) will be installed to control the supply fan speed. The existing dual duct mixing boxes will be replaced with dual duct VAV terminal units. The existing ductwork will remain.

- Convert the existing multizone AHU serving Building 7665 to a VAV AHU. A VSD will be installed to control the supply and return fan speed. VAV terminal units with reheat coils will be installed on the zone supply air ducts. The existing ductwork will remain.

- Convert the existing dual duct AHU serving Building 7670 to a VAV AHU. A VSD will be installed to control the supply and return fan speed. The existing dual duct mixing boxes will be replaced with dual duct VAV terminal units. The existing ductwork will remain.

11. REQUIREMENT:

Project: This Federal Energy Management Program (FEMP) project will convert the existing dual duct and multizone AHUs to VAV AHUs in the dental clinics, Buildings 602, 7665, and 7670.

Requirement: This project is required to reduce the natural gas and electrical consumption of the existing dual duct and multizone AHUs by reducing their air flow rates through VAV technology. An immediate utility savings would be recognized.

Current Situation: The dental clinic buildings are single story buildings with the following floor areas and HVAC system types:

- Building 602 is a 11,560 sq ft building and is heated and cooled by a dual duct AHU.
- Building 7665 is a 11,080 sq ft building and is heated and cooled by a multizone AHU.
- Building 7670 is a 14,960 sq ft building and is heated and cooled by a dual duct AHU.

1. COMPONENT ARMY	FY 1995 MILITARY CONSTRUCTION PROJECT DATA	2. DATE MAY 95

3. INSTALLATION AND LOCATION
Fort Riley, Kansas

4. PROJECT TITLE Upgrade HVAC Systems in Dental Clinics	5. PROJECT NUMBER

11. REQUIREMENT (continued):

Impact if Not Provided: If this project is not funded, a reduction of 1,459 MBtu/yr (1,537,778 MJ/yr) cannot be achieved. The Army will not realize a $23,779 annual energy dollar savings with a 3.7 year simple payback and a savings-to-investment ratio (SIR) of 4.22. Excessive amounts of natural gas and electricity will continue to be used, and there will be no contribution to energy reduction goals established for U.S. Army facilities by Army Headquarters.

Supporting Documentation: Supporting data includes basic engineering calculations which show energy savings. The supporting data was documented and conducted under an Army contract performed by an A-E firm (EMC Engineers, Inc.) in FY95.

Verification of Savings: The Fort Riley Army facility uses existing electrical meters and natural gas meters which are read monthly by the local utility companies. Historic monthly electrical and natural gas use data are available and can be obtained for monthly billing periods. The energy use for billing periods prior to the FEMP project implementation can be compared to the energy use for billing periods subsequent to the FEMP project implementation.

Amount of Energy Conserved: The amount of energy conserved is estimated to be 1,459 MBtu per year (1,537,778 MJ/yr).

LIFE CYCLE COST ANALYSIS SUMMARY
FEDERAL ENERGY MANAGEMENT PROGRAM (FEMP)

LOCATION:	Fort Riley	REGION: 2 (Kansas)		PROJECT NO:	1406-005
PROJECT TITLE:	Upgrade HVAC Systems in Dental Clinics			FISCAL YEAR:	1995
ANALYSIS DATE:	05/24/95	ECONOMIC LIFE:	20	PREPARED BY:	A. Niemeyer

1. INVESTMENT: **Dental Clinic Buildings 602, 7665, and 7670 - Convert DD AHUs and MZ AHU to VAV AHUs**

A.	CONSTRUCTION COST	=	$78,841	
B.	SIOH COST	(5.5% of 1A) =	$4,336	
C.	DESIGN COST	(6.0% of 1A) =	$4,730	
D.	TOTAL COST	(1A +1B +1C) =	$87,908	
E.	SALVAGE VALUE OF EXISTING EQUIPMENT =		$0	
F.	PUBLIC UTILITY COMPANY REBATE =		$0	
G.	TOTAL INVESTMENT	(1D -1E -1F) =	------->	$87,908

2. ENERGY SAVINGS (+) OR COST (-):

DATE OF NISTR 85-3273-9 USED FOR DISCOUNT FACTORS: JAN '95

	ENERGY SOURCE	FUEL COS $/MBTU (1	SAVINGS MBTU/YR (2)	ANNUAL $ SAVINGS (3)	DISCOUNT FACTOR (4)	DISCOUNTED SAVINGS (5)	
A.	ELECT.	$12.10	1,871	$22,639	15.88	$359,509	
B.	DIST	$0.00	0	$0	19.16	$0	
C.	NAT GAS	$4.12	(412)	($1,697)	18.30	($31,063)	
D.	COAL	$0.00	0	$0	16.62	$0	
E.	DEMAND (KW)			$2,837	14.88	$42,215	
F.	TOTAL		1,459	$23,779		-------->	$370,660

3. NON-ENERGY SAVINGS (+) OR COST (-)

A. ANNUAL RECURRING (+/-)

1 ANNUAL MAINTENANCE	$0	14.88	$0
2	$0	14.88	$0
3	$0	14.88	$0
4 TOTAL ANNUAL DISC. SAVINGS (+) / COST	$0		$0

B. NON-RECURRING (+/-)

ITEM	SAVINGS (+) COST(-) (1)	YEAR OF OCCURRENCE (2)	DISCOUNT FACTOR (3) (TABLE A-2)	DISCOUNTED AVINGS/COST (4)
a. BASELINE EQUIP. REPLCMNT.	$0	5	0.863	$0
b.				$0
c.				$0
d.				$0
e.				$0
f. TOTAL	$0			$0

C. TOTAL NON-ENERGY DISCOUNTED SAVINGS (+) OR COST (-) (3A4 + 3Bf4) = $0

4.	FIRST YEAR DOLLAR SAVINGS (+) / COSTS (-)	(2F3+3A4+(3Bf1/Economic Life))	$23,779
5.	SIMPLE PAYBACK (SPB) IN YEARS (MUST BE < 10 YEARS TO QUALIFY)	(1G/4) =	3.70
6.	TOTAL NET DISCOUNTED SAVINGS	(2F5 + 3C) =	$370,660
7.	DISCOUNTED SAVINGS-TO-INVESTMENT RATIO (SIR) (MUST HAVE SIR > 1.25 TO QUALIFY)	(6/1G) =	4.22

FEMP Project No. 2

Upgrade HVAC Systems in Dining Facilities
Buildings 7245, 7606, and 7654

1. COMPONENT ARMY	FY 1995 MILITARY CONSTRUCTION PROJECT DATA	2. DATE MAY 95

3. INSTALLATION AND LOCATION	4. PROJECT TITLE
Fort Riley, Kansas	Upgrade HVAC Systems in Dining Facilities

5. PROGRAM ELEMENT	6. CATEGORY CODE	7. PROJECT NUMBER	8. PROJECT COST ($000)

9. COST ESTIMATES

ITEM	U/M	QUANTITY	UNIT COST	COST ($000)
Upgrade HVAC Systems in Dining Facilities	LS			558
TOTAL CONTRACT COST				558
SIOH (5.5%)				31
DESIGN COST (6.0%)				33
TOTAL PROJECT COST				622
Total Request (Rounded)				625

10. DESCRIPTION OF PROPOSED CONSTRUCTION

The proposed construction consists of upgrading the HVAC systems in the dining facilities, Buildings 7245, 7606, and 7654. The HVAC system upgrades include the following:

- Replace existing single zone air handling units (AHUs) serving the dining areas with variable-air-volume (VAV) AHUs. VAV terminal units with reheat coils will be installed on the zone supply air ducts. The existing ductwork will remain.
- Replace existing make-up air handling units (MAUs) serving the kitchen areas with heat recovery air handling units (HRUs). The exhaust fans interlocked with the MAUs will be removed. Exhaust air ductwork will be provided at the roof exhaust air outlets and connected to the inlets on the HRUs.
- Replace the existing steam boiler serving both space heating and service water heating with separate boilers for each of the loads. An energy efficient hot water boiler will be installed for space heating. An energy efficient steam boiler will be installed for service water heating.

11. REQUIREMENT:

Project: This Federal Energy Management Program (FEMP) project will replace the following HVAC systems in the dining facilities, Buildings 7245, 7606, and 7654:

- Replace the existing single zone AHUs withVAV AHUs
- Replace the MAUs with HRUs
- Replace the steam boiler serving both space and service water heating loads with separate boilers for each load.

Requirement: This project is required to reduce the natural gas and electrical energy consumption of the existing single zone AHUs by replacement with VAV AHUs, of the existing MAUs by replacement with HRUs, and of the existing steam boiler by replacement with smaller energy efficient boilers. An immediate utility savings would be recognized.

Current Situation: The dining facilities are single story, 14,000 sq ft buildings with single zone AHUs serving the dining areas, MAUs serving the kitchen areas, and a large steam boiler serving the space heating and service water heating loads.

1. COMPONENT ARMY	FY 1995 MILITARY CONSTRUCTION PROJECT DATA	2. DATE MAY 95

3. INSTALLATION AND LOCATION
Fort Riley, Kansas

4. PROJECT TITLE Upgrade HVAC Systems in Dining Facilities	5. PROJECT NUMBER

11. REQUIREMENT (continued):

__Impact if Not Provided:__ If this project is not funded, a reduction of 15,117 MBtu/yr (15,933,318 MJ/yr) cannot be achieved. The Army will not realize a $71,100 annual energy dollar savings with a 6.65 year simple payback and a savings-to-investment ratio (SIR) of 2.66. Excessive amounts of natural gas and electricity will continue to be used, and there will be no contribution to energy reduction goals established for U.S. Army facilities by Army Headquarters.

__Supporting Documentation:__ Supporting data includes basic engineering calculations which show energy savings. The supporting data was documented and conducted under an Army contract performed by an A-E firm (EMC Engineers, Inc.) in FY95.

__Verification of Savings:__ The Fort Riley Army facility uses existing electrical meters and natural gas meters which are read monthly by the local utility companies. Historic monthly electrical and natural gas use data are available and can be obtained for monthly billing periods. The energy use for billing periods prior to the FEMP project implementation can be compared to the energy use for billing periods subsequent to the FEMP project implementation.

__Amount of Energy Conserved:__ The amount of energy conserved is estimated to be 15,117 MBtu per year (15,933,318 MJ/yr).

LIFE CYCLE COST ANALYSIS SUMMARY

FEDERAL ENERGY MANAGEMENT PROGRAM (FEMP)

LOCATION:	Fort Riley	REGION: 2 (Kansas)		PROJECT NO:	1406-005
PROJECT TITLE:	Upgrade HVAC Systems in Dining Facilities			FISCAL YEAR:	1995
ANALYSIS DATE:	05/24/95	ECONOMIC LIFE:	20	PREPARED BY:	A. Niemeyer

1. INVESTMENT: **Dining Facilities Buildings 7245, 7606, and 7654 - Replace SZ AHUs with VAV AHUs; Replace MAUs with HRUs; Replace Large Steam Boiler with Smaller HW Boiler and Steam Boiler**

A.	CONSTRUCTION COST	=	$558,179	
B.	SIOH COST	(5.5% of 1A) =	$30,700	
C.	DESIGN COST	(6.0% of 1A) =	$33,491	
D.	TOTAL COST	(1A +1B +1C) =	$622,370	
E.	SALVAGE VALUE OF EXISTING EQUIPMENT =		$0	
F.	PUBLIC UTILITY COMPANY REBATE =		$0	
G.	TOTAL INVESTMENT	(1D -1E -1F) =	------->	$622,370

2. ENERGY SAVINGS (+) OR COST (-):

DATE OF NISTR 85-3273-9 USED FOR DISCOUNT FACTORS: JAN '95

	ENERGY SOURCE	FUEL COS $/MBTU (1	SAVINGS MBTU/YR (2)	ANNUAL $ SAVINGS (3)	DISCOUNT FACTOR (4)	DISCOUNTED SAVINGS (5)	
A.	ELECT.	$12.10	837	$10,128	15.88	$160,828	
B.	DIST	$0.00	0	$0	19.16	$0	
C.	NAT GAS	$4.12	14,280	$58,834	18.30	$1,076,655	
D.	COAL	$0.00	0	$0	16.62	$0	
E.	DEMAND (KW)			$2,139	14.88	$31,828	
F.	TOTAL		15,117	$71,100		-------->	$1,269,311

3. NON-ENERGY SAVINGS (+) OR COST (-)

A. ANNUAL RECURRING (+/-)

1 ANNUAL MAINTENANCE	($543)	14.88	($8,080)
2	$0	14.88	$0
3	$0	14.88	$0
4 TOTAL ANNUAL DISC. SAVINGS (+) / COST	($543)		($8,080)

B. NON-RECURRING (+/-)

ITEM	SAVINGS (+) COST(-) (1)	YEAR OF OCCURRENCE (2)	DISCOUNT FACTOR (3) (TABLE A-2)	DISCOUNTED AVINGS/COST (4)
a. BASELINE EQUIP. REPLCMNT.	$460,107	5	0.863	$397,072
b.				$0
c.				$0
d.				$0
e.				$0
f. TOTAL	$460,107			$397,072

C. TOTAL NON-ENERGY DISCOUNTED SAVINGS (+) OR COST (-) (3A4 + 3Bf4) = $388,993

4.	FIRST YEAR DOLLAR SAVINGS (+) / COSTS (-)	(2F3+3A4+(3Bf1/Economic Life))	$93,563
5.	SIMPLE PAYBACK (SPB) IN YEARS (MUST BE < 10 YEARS TO QUALIFY)	(1G/4) =	6.65
6.	TOTAL NET DISCOUNTED SAVINGS	(2F5 + 3C) =	$1,658,304
7.	DISCOUNTED SAVINGS-TO-INVESTMENT RATIO (SIR) (MUST HAVE SIR > 1.25 TO QUALIFY)	(6/1G) =	2.66

FEMP Project No. 3

Upgrade HVAC Systems in Indoor Swimming Pools
Buildings 6940 and 8069

1. COMPONENT ARMY	FY 1995 MILITARY CONSTRUCTION PROJECT DATA	2. DATE MAY 95

3. INSTALLATION AND LOCATION Fort Riley, Kansas	4. PROJECT TITLE Upgrade HVAC Systems in Indoor Swimming Pool Buildings

5. PROGRAM ELEMENT	6. CATEGORY CODE	7. PROJECT NUMBER	8. PROJECT COST ($000)

9. COST ESTIMATES

ITEM	U/M	QUANTITY	UNIT COST	COST ($000)
Upgrade HVAC Systems in Indoor Swimming Pool Buildings	LS			335
TOTAL CONTRACT COST				335
SIOH (5.5%)				18
DESIGN COST (6.0%)				20
TOTAL PROJECT COST				373
Total Request (Rounded)				375

10. DESCRIPTION OF PROPOSED CONSTRUCTION

The proposed construction consists of upgrading the HVAC systems in the indoor swimming pools, Buildings 6940 and 8069. The HVAC system upgrades include the following:

- Replace the existing heating and ventilating unit (H&V) serving the swimming pool area of Building 6940 with a heat recovery air handling unit (HRU). Exhaust ductwork will be installed to exhaust the air out through the roof. A roof outlet will be installed for the exhaust air. The existing outside air ductwork will remain.
- Replace four existing H&Vs serving the swimming pool area of Building 8069 with two HRUs. Exhaust ductwork will be installed to exhaust the air out through the roof. A roof outlet will be installed for the exhaust air. The existing outside air ductwork will remain.

11. REQUIREMENT:

Project: This Federal Energy Management Program (FEMP) project will replace the existing H&Vs with HRUs in the indoor swimming pools, Buildings 6940 and 8069.

Requirement: This project is required to reduce the natural gas and electrical consumption by replacement of the existing H&Vs with HRUs. An immediate utility savings would be recognized.

Current Situation: The indoor swimming pool, Building 6940, is a 23,450 sq ft single story building with the pool area heated and ventilated by a H&V. The indoor swimming pool and gymnasium, Building 8069, is a 25,620 sq ft two story building with the pool area heated and ventilated by four H&Vs.

1. COMPONENT ARMY	FY 1995 MILITARY CONSTRUCTION PROJECT DATA	2. DATE MAY 95

3. INSTALLATION AND LOCATION
Fort Riley, Kansas

4. PROJECT TITLE Upgrade HVAC Systems in Indoor Swimming Pool Buildings	5. PROJECT NUMBER

11. REQUIREMENT (continued):

Impact if Not Provided: If this project is not funded, a reduction of 11,951 MBtu/yr (12,596,354 MJ/yr) cannot be achieved. The Army will not realize a $57,226 annual energy dollar savings with a 6.32 year simple payback and a savings-to-investment ratio (SIR) of 2.81. Excessive amounts of natural gas and electricity will continue to be used, and there will be no contribution to energy reduction goals established for U.S. Army facilities by Army Headquarters.

Supporting Documentation: Supporting data includes basic engineering calculations which show energy savings. The supporting data was documented and conducted under an Army contract performed by an A-E firm (EMC Engineers, Inc.) in FY95.

Verification of Savings: The Fort Riley Army facility uses existing electrical meters and natural gas meters which are read monthly by the local utility companies. Historic monthly electrical and natural gas use data are available and can be obtained for monthly billing periods. The energy use for billing periods prior to the FEMP project implementation can be compared to the energy use for billing periods subsequent to the FEMP project implementation.

Amount of Energy Conserved: The amount of energy conserved is estimated to be 11,951 MBtu per year (12,596,354 MJ/yr).

LIFE CYCLE COST ANALYSIS SUMMARY

FEDERAL ENERGY MANAGEMENT PROGRAM (FEMP)

LOCATION:	Fort Riley	REGION: 2 (Kansas)		PROJECT NO:	1406-005
PROJECT TITLE:	Upgrade HVAC Systems in Indoor Swimming Pools			FISCAL YEAR:	1995
ANALYSIS DATE:	05/24/95	ECONOMIC LIFE:	20	PREPARED BY:	A. Niemeyer

1. INVESTMENT: **Indoor Swimming Pools in Buildings 6940 and 8069 - Replace existing H&Vs with HRUs**

A.	CONSTRUCTION COST	=	$334,555	
B.	SIOH COST	(5.5% of 1A) =	$18,401	
C.	DESIGN COST	(6.0% of 1A) =	$20,073	
D.	TOTAL COST	(1A +1B +1C) =	$373,029	
E.	SALVAGE VALUE OF EXISTING EQUIPMENT =		$0	
F.	PUBLIC UTILITY COMPANY REBATE =		$0	
G.	TOTAL INVESTMENT	(1D -1E -1F) =	------->	$373,029

2. ENERGY SAVINGS (+) OR COST (-):

DATE OF NISTR 85-3273-9 USED FOR DISCOUNT FACTORS: JAN '95

	ENERGY SOURCE	FUEL COS $/MBTU (1	SAVINGS MBTU/YR (2)	ANNUAL $ SAVINGS (3)	DISCOUNT FACTOR (4)	DISCOUNTED SAVINGS (5)	
A.	ELECT.	$12.10	1,001	$12,112	15.88	$192,340	
B.	DIST	$0.00	0	$0	19.16	$0	
C.	NAT GAS	$4.12	10,950	$45,114	18.30	$825,586	
D.	COAL	$0.00	0	$0	16.62	$0	
E.	DEMAND (KW)			$0	14.88	$0	
F.	TOTAL		11,951	$57,226		-------->	$1,017,926

3. NON-ENERGY SAVINGS (+) OR COST (-)

A. ANNUAL RECURRING (+/-)

1 ANNUAL MAINTENANCE	$0	14.88	$0
2	$0	14.88	$0
3	$0	14.88	$0
4 TOTAL ANNUAL DISC. SAVINGS (+) / COST	$0		$0

B. NON-RECURRING (+/-)

ITEM	SAVINGS (+) COST(-) (1)	YEAR OF OCCURRENCE (2)	DISCOUNT FACTOR (3) (TABLE A-2)	DISCOUNTED AVINGS/COST (4)
a. BASELINE EQUIP. REPLCMNT.	$35,706	5	0.863	$30,814
b.				$0
c.				$0
d.				$0
e.				$0
f. TOTAL	$35,706			$30,814

C. TOTAL NON-ENERGY DISCOUNTED SAVINGS (+) OR COST (-) (3A4 + 3Bf4) = $30,814

4.	FIRST YEAR DOLLAR SAVINGS (+) / COSTS (-)	(2F3+3A4+(3Bf1/Economic Life))	$59,011
5.	SIMPLE PAYBACK (SPB) IN YEARS (MUST BE < 10 YEARS TO QUALIFY)	(1G/4) =	6.32
6.	TOTAL NET DISCOUNTED SAVINGS	(2F5 + 3C) =	$1,048,741
7.	DISCOUNTED SAVINGS-TO-INVESTMENT RATIO (SIR) (MUST HAVE SIR > 1.25 TO QUALIFY)	(6/1G) =	2.81

FEMP Project No. 4

Upgrade HVAC Systems in Bowling Alley and Community Activities Center

Bowling Alley - Building 7485
Community Activities Center - Building 6620

1. COMPONENT ARMY	FY 1995 MILITARY CONSTRUCTION PROJECT DATA	2. DATE MAY 95

3. INSTALLATION AND LOCATION	4. PROJECT TITLE
Fort Riley, Kansas	Upgrade HVAC Systems in Bowling Alley and Community Activities Center

5. PROGRAM ELEMENT	6. CATEGORY CODE	7. PROJECT NUMBER	8. PROJECT COST ($000)

9. COST ESTIMATES

ITEM	U/M	QUANTITY	UNIT COST	COST ($000)
Upgrade HVAC Systems in Bowling Alley and Community Activities Center	LS			67
TOTAL CONTRACT COST				67
SIOH (5.5%)				4
DESIGN COST (6.0%)				4
TOTAL PROJECT COST				75
Total Request (Rounded)				80

10. DESCRIPTION OF PROPOSED CONSTRUCTION

The proposed construction consists of upgrading the HVAC systems in the Bowling Alley, Building 7485 and the Community Activities Center, Building 6620. The HVAC system upgrades include the following:

- Convert the existing dual duct air handling unit (AHU) serving Building 7485 to a variable-air-volume (VAV) AHU. A variable speed drive (VSD) will be installed to control the supply fan speed. The existing dual duct mixing boxes will be replaced with dual duct VAV terminal units. The existing ductwork will remain.

- In Building 6620, replace two existing single zone air handling units (AHUs) serving the ballroom and the dining room with VAV AHUs. VAV terminal units with reheat coils will be installed on the zone supply air ducts. The existing ductwork will remain.

- Convert the existing multizone AHU serving Building 6620 to a VAV AHU. A VSD will be installed to control the supply fan speed. VAV terminal units with reheat coils will be installed on the zone supply air ducts. The existing ductwork will remain.

11. REQUIREMENT:

Project: This Federal Energy Management Program (FEMP) project will convert the existing dual duct AHU in Building 7485 to a dual duct VAV AHU. This project will also replace the existing single zone AHUs in Building 6620 with VAV AHUs and convert the existing multizone AHU to a VAV AHU.

Requirement: This project is required to reduce natural gas and electrical energy consumption by replacement of existing single zone AHUs with VAV AHUs, by conversion of a dual duct AHU to a dual duct VAV AHU, and by conversion of a multizone AHU to a VAV AHU. An immediate utility savings would be recognized.

Current Situation: The Bowling Alley, Building 7485, is a 36,970 sq ft single story building with the bowling lanes heated and cooled by a dual duct AHU. The Community Activities Center, Building 6620, is a 31,740 sq ft two story building with the ballroom and dining room heated and cooled by single zone AHUs, and an office administration area heated and cooled by a multizone AHU.

1. COMPONENT ARMY	FY 1995 MILITARY CONSTRUCTION PROJECT DATA	2. DATE MAY 95

3. INSTALLATION AND LOCATION
Fort Riley, Kansas

4. PROJECT TITLE Upgrade HVAC Systems in Bowling Alley and Community Activities Center	5. PROJECT NUMBER

11. REQUIREMENT (continued):

Impact if Not Provided: If this project is not funded, a reduction of 1,039 MBtu/yr (1,095,106 MJ/yr) cannot be achieved. The Army will not realize a $14,661 annual energy dollar savings with a 4.65 year simple payback and a savings-to-investment ratio (SIR) of 3.41. Excessive amounts of natural gas and electricity will continue to be used, and there will be no contribution to energy reduction goals established for U.S. Army facilities by Army Headquarters.

Supporting Documentation: Supporting data includes basic engineering calculations which show energy savings. The supporting data was documented and conducted under an Army contract performed by an A-E firm (EMC Engineers, Inc.) in FY95.

Verification of Savings: The Fort Riley Army facility uses existing electrical meters and natural gas meters which are read monthly by the local utility companies. Historic monthly electrical and natural gas use data are available and can be obtained for monthly billing periods. The energy use for billing periods prior to the FEMP project implementation can be compared to the energy use for billing periods subsequent to the FEMP project implementation.

Amount of Energy Conserved: The amount of energy conserved is estimated to be 1,039 MBtu per year (1,095,106 MJ/yr).

LIFE CYCLE COST ANALYSIS SUMMARY

FEDERAL ENERGY MANAGEMENT PROGRAM (FEMP)

LOCATION:	Fort Riley	REGION: 2 (Kansas)		PROJECT NO:	1406-005
PROJECT TITLE:	Upgrade HVAC Systems in Bowling Alley and Comm Act Cntr			FISCAL YEAR:	1995
ANALYSIS DATE:	05/24/95	ECONOMIC LIFE:	20	PREPARED BY:	A. Niemeyer

Building 7485 - Convert existing DD AHU to a DD VAV AHU; Building 6620 - Replace existing

1. INVESTMENT: **Building 6620 - Replace existing SZ AHUs with VAV AHUs, and Convert existing MZ AHU to a VAV AHU**

A.	CONSTRUCTION COST	=	$67,449	
B.	SIOH COST	(5.5% of 1A) =	$3,710	
C.	DESIGN COST	(6.0% of 1A) =	$4,047	
D.	TOTAL COST	(1A +1B +1C) =	$75,206	
E.	SALVAGE VALUE OF EXISTING EQUIPMENT =		$0	
F.	PUBLIC UTILITY COMPANY REBATE =		$0	
G.	TOTAL INVESTMENT	(1D -1E -1F) =	------->	$75,206

2. ENERGY SAVINGS (+) OR COST (-):

DATE OF NISTR 85-3273-9 USED FOR DISCOUNT FACTORS: JAN '95

	ENERGY SOURCE	FUEL COS $/MBTU (1	SAVINGS MBTU/YR (2)	ANNUAL $ SAVINGS (3)	DISCOUNT FACTOR (4)	DISCOUNTED SAVINGS (5)	
A.	ELECT.	$12.10	1,142	$13,818	15.88	$219,433	
B.	DIST	$0.00	0	$0	19.16	$0	
C.	NAT GAS	$4.12	(103)	($424)	18.30	($7,766)	
D.	COAL	$0.00	0	$0	16.62	$0	
E.	DEMAND (KW)			$1,267	14.88	$18,853	
F.	TOTAL		1,039	$14,661		-------->	$230,520

3. NON-ENERGY SAVINGS (+) OR COST (-)

A. ANNUAL RECURRING (+/-)

1 ANNUAL MAINTENANCE	$0	14.88	$0
2	$0	14.88	$0
3	$0	14.88	$0
4 TOTAL ANNUAL DISC. SAVINGS (+) / COST	$0		$0

B. NON-RECURRING (+/-)

ITEM	SAVINGS (+) COST(-) (1)	YEAR OF OCCURRENCE (2)	DISCOUNT FACTOR (3) (TABLE A-2)	DISCOUNTED AVINGS/COST (4)
a. BASELINE EQUIP. REPLCMNT.	$30,326	5	0.863	$26,171
b.				$0
c.				$0
d.				$0
e.				$0
f. TOTAL	$30,326			$26,171

C.	TOTAL NON-ENERGY DISCOUNTED SAVINGS (+) OR COST (-)	(3A4 + 3Bf4) =	$26,171
4.	FIRST YEAR DOLLAR SAVINGS (+) / COSTS (-)	(2F3+3A4+(3Bf1/Economic Life))	$16,177
5.	SIMPLE PAYBACK (SPB) IN YEARS (MUST BE < 10 YEARS TO QUALIFY)	(1G/4) =	4.65
6.	TOTAL NET DISCOUNTED SAVINGS	(2F5 + 3C) =	$256,692
7.	DISCOUNTED SAVINGS-TO-INVESTMENT RATIO (SIR) (MUST HAVE SIR > 1.25 TO QUALIFY)	(6/1G) =	3.41

FEMP Project No. 5

Upgrade HVAC Systems in Fire Station, Unit Chapel, Motor Pool Admin, and Battalion Headquarters

Fire Station - Building 5000
Unit Chapel - Building 7086
Motor Pool Admin - Building 7178
Battalion Headquarters - Building 7806

1. COMPONENT ARMY	FY 1995 MILITARY CONSTRUCTION PROJECT DATA	2. DATE MAY 95

3. INSTALLATION AND LOCATION	4. PROJECT TITLE
Fort Riley, Kansas	Upgrade HVAC Systems in Fire Station, Unit Chapel, Motor Pool Admin and Battalion Headquarters

5. PROGRAM ELEMENT	6. CATEGORY CODE	7. PROJECT NUMBER	8. PROJECT COST ($000)

9. COST ESTIMATES

ITEM	U/M	QUANTITY	UNIT COST	COST ($000)
Upgrade HVAC Systems in Fire Station, Unit Chapel, Motor Pool Admin, and Battalion Headquarters	LS			97
TOTAL CONTRACT COST				97
SIOH (5.5%)				5
DESIGN COST (6.0%)				6
TOTAL PROJECT COST				108
Total Request (Rounded)				110

10. DESCRIPTION OF PROPOSED CONSTRUCTION

The proposed construction consists of upgrading the HVAC systems in the Fire Station - Building 5000, the Unit Chapel - Building 7086, the Motor Pool Admin - Building 7178, and the Battalion Headquarters - Building 7806. The HVAC system upgrades include the following:

- Replace the existing multizone air handling unit (AHU) serving Building 5000 with three furnace air conditioning units (FACs). The supply air ductwork will be modified to serve three zones instead of the existing five zones. The existing air cooled condensing unit (ACCU) will be replaced with three ACCUs each serving the FACs. The existing boiler will be replaced with a smaller modular HW boiler, and will serve the heating and ventilating unit only.

- Replace the existing single zone AHU serving Building 7086 with a variable-air-volume (VAV) AHU. VAV terminal units with reheat coils will be installed on the zone supply air ducts. The existing ductwork will remain.

- Replace three existing window air conditioners (WACs) serving Building 7178 with a single zone AHU. Supply air ductwork with supply grilles will be installed. An ACCU will be installed to provide cooling to the single zone AHU.

- Replace two existing single zone AHUs serving Building 7806 with VAV AHUs. VAV terminal units with reheat coils will be installed on the zone supply air ducts. The existing ductwork will remain.

11. REQUIREMENT:

<u>**Project:**</u> This Federal Energy Management Program (FEMP) project will replace the existing multizone AHU in Building 5000 with three FACs. Also in Building 5000, the existing ACCU will be replaced with three smaller ACCUs, and the HW boiler will be replaced with a smaller HW boiler. This project will also replace the existing single zone AHU in Building 7086 with a VAV AHU; replace three WACs with a single zone AHU and an ACCU in Building 7178; and replace two single zone AHUs with VAV AHUs in Building 7806.

1. COMPONENT ARMY	FY 1995 MILITARY CONSTRUCTION PROJECT DATA	2. DATE MAY 95

3. INSTALLATION AND LOCATION
Fort Riley, Kansas

4. PROJECT TITLE Upgrade HVAC Systems in Fire Station, Unit Chapel, Motor Pool Admin and Battalion Headquarters	5. PROJECT NUMBER

11. REQUIREMENT (continued):

Requirement: This project is required to reduce natural gas and electrical energy consumption by replacement of a multizone AHU with three FACs; by replacement of an existing ACCU with three smaller ACCUs and an existing HW boiler with a smaller modular HW boiler; by replacement of three WACs with a single zone AHU and ACCU; and by replacment of existing single zone AHUs with VAV AHUs. An immediate utility savings would be recognized.

Current Situation: The Fire Station, Building 5000, is a 8,400 sq ft single story building with the quarters and communication center heated and cooled by a multizone AHU. The Unit Chapel, Building 7086, is a 8,700 sq ft single story building with the church sanctuary heated and cooled by a single zone AHU. The Motor Pool Admin, Building 7178, is a 2,480 sq ft single story building cooled by three WACs. The Battalion Headquarters, Building 7806 is a 13,490 sq ft single story building heated and cooled by two single zone AHUs.

Impact if Not Provided: If this project is not funded, a reduction of 712 MBtu/yr (750,448 MJ/yr) cannot be achieved. The Army will not realize a $8,533 annual energy dollar savings with a 7.36 year simple payback and a savings-to-investment ratio (SIR) of 2.23. Excessive amounts of natural gas and electricity will continue to be used, and there will be no contribution to energy reduction goals established for U.S. Army facilities by Army Headquarters.

Supporting Documentation: Supporting data includes basic engineering calculations which show energy savings. The supporting data was documented and conducted under an Army contract performed by an A-E firm (EMC Engineers, Inc.) in FY95.

Verification of Savings: The Fort Riley Army facility uses existing electrical meters and natural gas meters which are read monthly by the local utility companies. Historic monthly electrical and natural gas use data are available and can be obtained for monthly billing periods. The energy use for billing periods prior to the FEMP project implementation can be compared to the energy use for billing periods subsequent to the FEMP project implementation.

Amount of Energy Conserved: The amount of energy conserved is estimated to be 712 MBtu per year (750,448 MJ/yr).

LIFE CYCLE COST ANALYSIS SUMMARY

FEDERAL ENERGY MANAGEMENT PROGRAM (FEMP)

LOCATION:	Fort Riley	REGION: 2 (Kansas)		PROJECT NO:	1406-005
PROJECT TITLE:	Upgrade HVAC Systs in Fire Stn, Chpl, Mtr Pl Admin, and Bn HQ			FISCAL YEAR:	1995
ANALYSIS DATE:	05/24/95	ECONOMIC LIFE:	20	PREPARED BY:	A. Niemeyer

Building 5000 - Replace existing MZ AHU with FACs, also replace ACCU with three smaller ACCUs and replace HW boiler with smaller modular HW boiler;

Building 7086 - Replace SZ AHU with VAV AHU;

Building 7178 - Replace three WACs with SZ AHU and ACCU;

Building 7806 - Replace SZ AHUs with VAV AHUs

1. INVESTMENT:

A.	CONSTRUCTION COST	=	$96,904	
B.	SIOH COST	(5.5% of 1A) =	$5,330	
C.	DESIGN COST	(6.0% of 1A) =	$5,814	
D.	TOTAL COST	(1A +1B +1C) =	$108,048	
E.	SALVAGE VALUE OF EXISTING EQUIPMENT =		$0	
F.	PUBLIC UTILITY COMPANY REBATE =		$0	
G.	TOTAL INVESTMENT	(1D -1E -1F) =	------->	$108,048

2. ENERGY SAVINGS (+) OR COST (-):

DATE OF NISTR 85-3273-9 USED FOR DISCOUNT FACTORS: JAN '95

	ENERGY SOURCE	FUEL COS $/MBTU (1	SAVINGS MBTU/YR (2)	ANNUAL $ SAVINGS (3)	DISCOUNT FACTOR (4)	DISCOUNTED SAVINGS (5)	
A.	ELECT.	$12.10	489	$5,917	15.88	$93,960	
B.	DIST	$0.00	0	$0	19.16	$0	
C.	NAT GAS	$4.12	223	$919	18.30	$16,813	
D.	COAL	$0.00	0	$0	16.62	$0	
E.	DEMAND (KW)			$1,697	14.88	$25,251	
F.	TOTAL		712	$8,533		-------->	$136,025

3. NON-ENERGY SAVINGS (+) OR COST (-)

A. ANNUAL RECURRING (+/-)

1	ANNUAL MAINTENANCE	$511	14.88	$7,604
2		$0	14.88	$0
3		$0	14.88	$0
4	TOTAL ANNUAL DISC. SAVINGS (+) / COST	$511		$7,604

B. NON-RECURRING (+/-)

ITEM	SAVINGS (+) COST(-) (1)	YEAR OF OCCURRENCE (2)	DISCOUNT FACTOR (3) (TABLE A-2)	DISCOUNTED AVINGS/COST (4)
a. BASELINE EQUIP. REPLCMNT.	$112,934	5	0.863	$97,462
b.				$0
c.				$0
d.				$0
e.				$0
f. TOTAL	$112,934			$97,462

C. TOTAL NON-ENERGY DISCOUNTED SAVINGS (+) OR COST (-) (3A4 + 3Bf4) = $105,066

4.	FIRST YEAR DOLLAR SAVINGS (+) / COSTS (-)	(2F3+3A4+(3Bf1/Economic Life))	$14,690
5.	SIMPLE PAYBACK (SPB) IN YEARS (MUST BE < 10 YEARS TO QUALIFY)	(1G/4) =	7.36
6.	TOTAL NET DISCOUNTED SAVINGS	(2F5 + 3C) =	$241,091
7.	DISCOUNTED SAVINGS-TO-INVESTMENT RATIO (SIR) (MUST HAVE SIR > 1.25 TO QUALIFY)	(6/1G) =	2.23